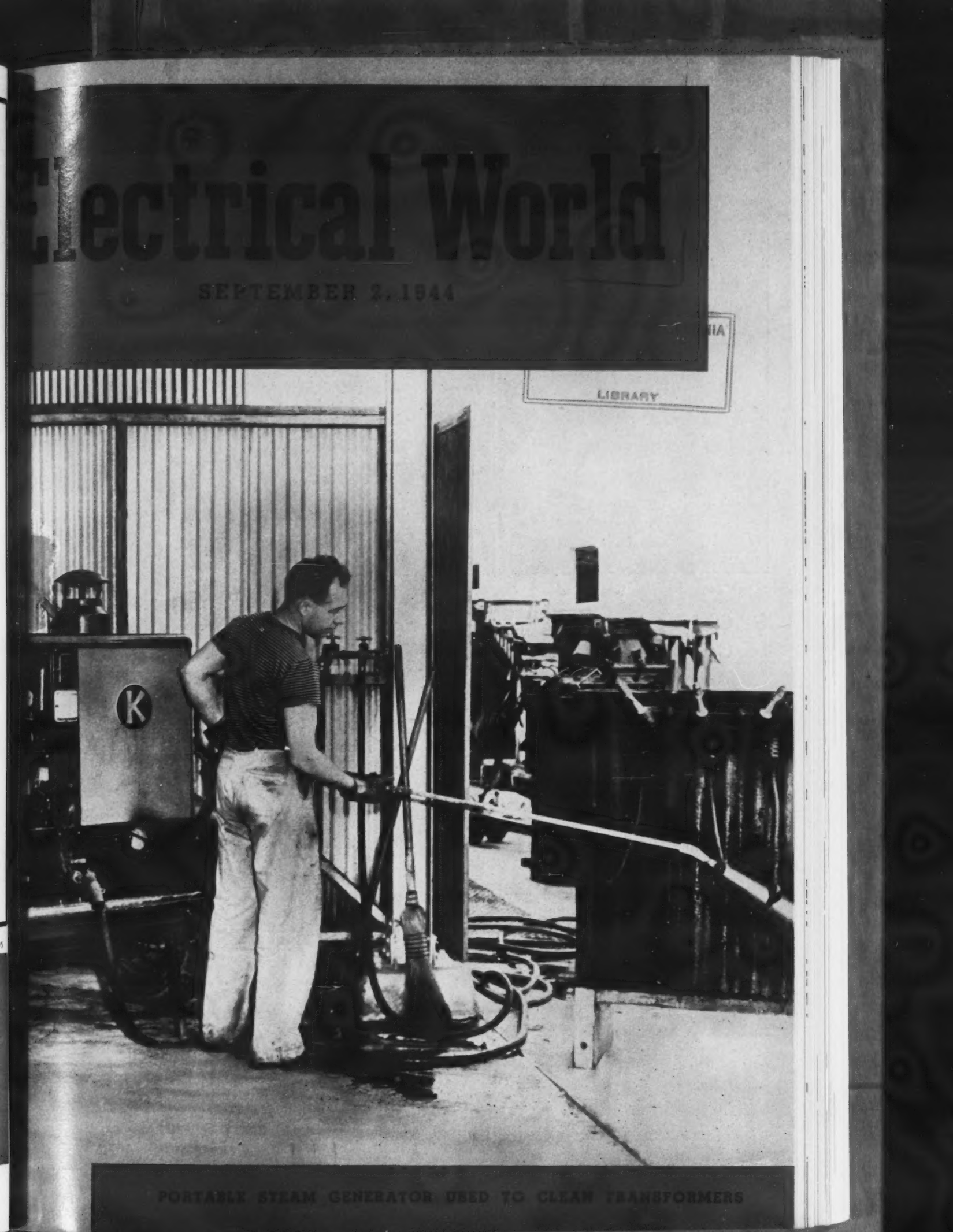
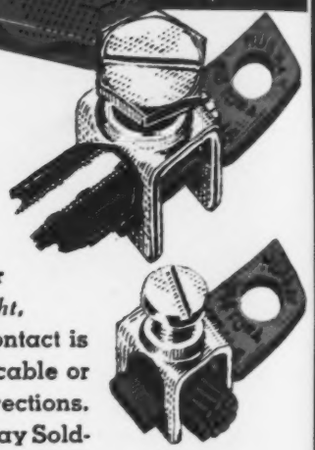


PORTABLE STEAM GENERATOR USED TO CLEAN TRANSFORMERS

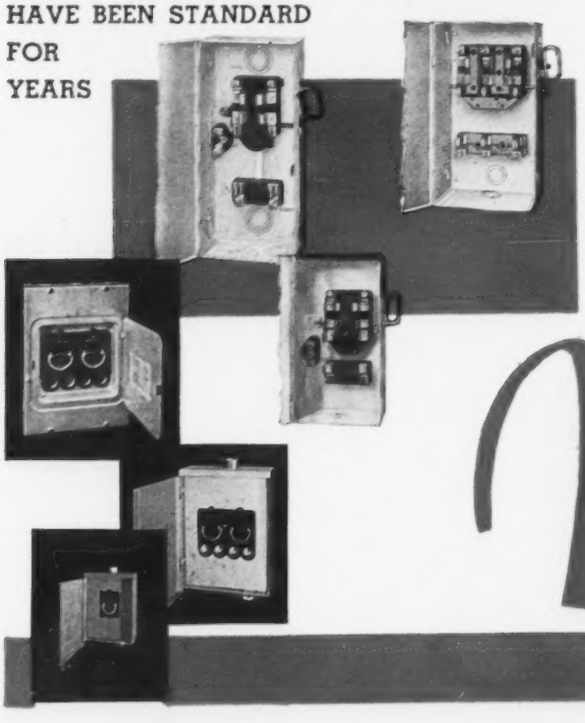
SOLDERLESS CONNECTORS THAT HOLD LIKE A VISE!

½" socket wrench for 3 larger sizes
Enormous pressure makes electrical contact absolute
Cable or wire can be inserted from any of 3 directions

FROM YOUR JOBBER — HE HAS THEM IN CONVENIENT, ECONOMY PACKAGES!



SOME FAMED MURRAY SWITCHES IN WHICH MURRAY SOLDERLESS CONNECTORS HAVE BEEN STANDARD FOR YEARS



So strong that they'll take all the tightening you will ever give them. When they're *tight*, they HOLD—and electrical contact is absolute. You can insert the cable or wire from any of *three* directions. These speedily-installed Murray Solderless Connectors have been standard in Murray Switches for years. Metropolitan Device Corporation, Brooklyn, N. Y.

SOLDERLESS CONNECTORS *by* Murray

METROPOLITAN DEVICE CORP. Brooklyn, N.Y.

Send price sheet and complete listing of Solderless Connectors

Name _____

Address _____

Electrical World

FOUNDED IN 1874 • READ BY ELECTRICAL MEN FOR 70 YEARS

September 2, 1944 — Vol. 122, No. 10

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From .....

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To .....

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Signed .....

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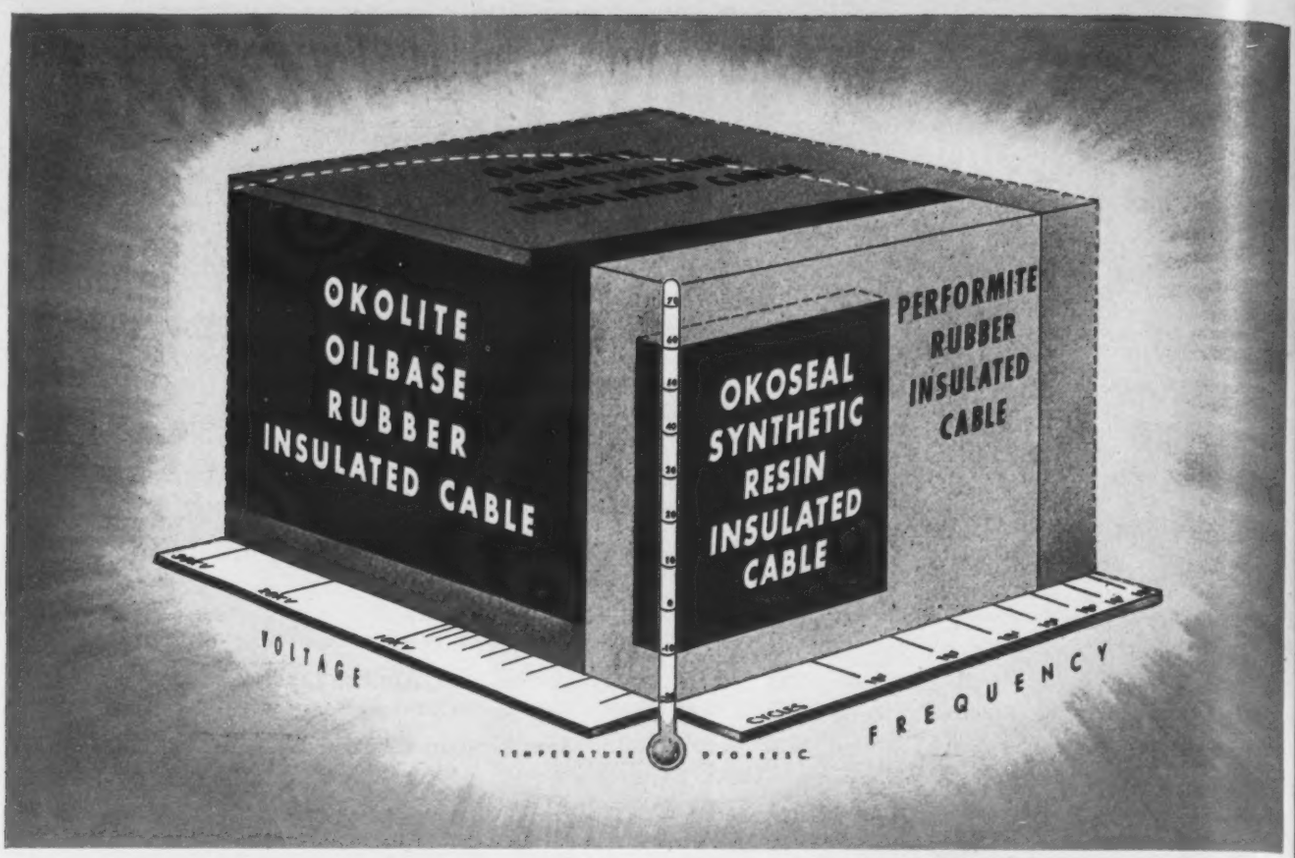


PERSPECTIVE: Selecting Insulated Cable Requires a Multi-Dimensional Approach

This 3-dimensional graph illustrates practical fields of usefulness of 4 widely-used types of cable insulation. Each type has particular characteristics that make it suitable for definite applications — but at the same time each possesses certain limitations.

The pictured values show the present maximum voltage, frequency and temperature limits for which these four insulations are commonly used. The insulations with the higher values can, in many cases, be used as alternatives for those having lower values.

Design engineers may find this rather unusual graph helpful in selecting a cable for some specific application. The problem, however, is not always as simple as indicated because it is often necessary to obtain cables having additional characteristics not covered by this graph — such as resistance to moisture, oil, chemicals, flame, etc.

Actually there are available many other insulations developed through Okonite Research — such as glass, paper, cambric, rubber and many synthetics — that cover the full range of electrical applications. Through intensive laboratory and long field experience, our engineers have acquired the over-all perspective that can help you select the *one* cable best suited for your purposes from *every* angle. Just outline your problem and let us make recommendations. The Okonite Company, Passaic, New Jersey.

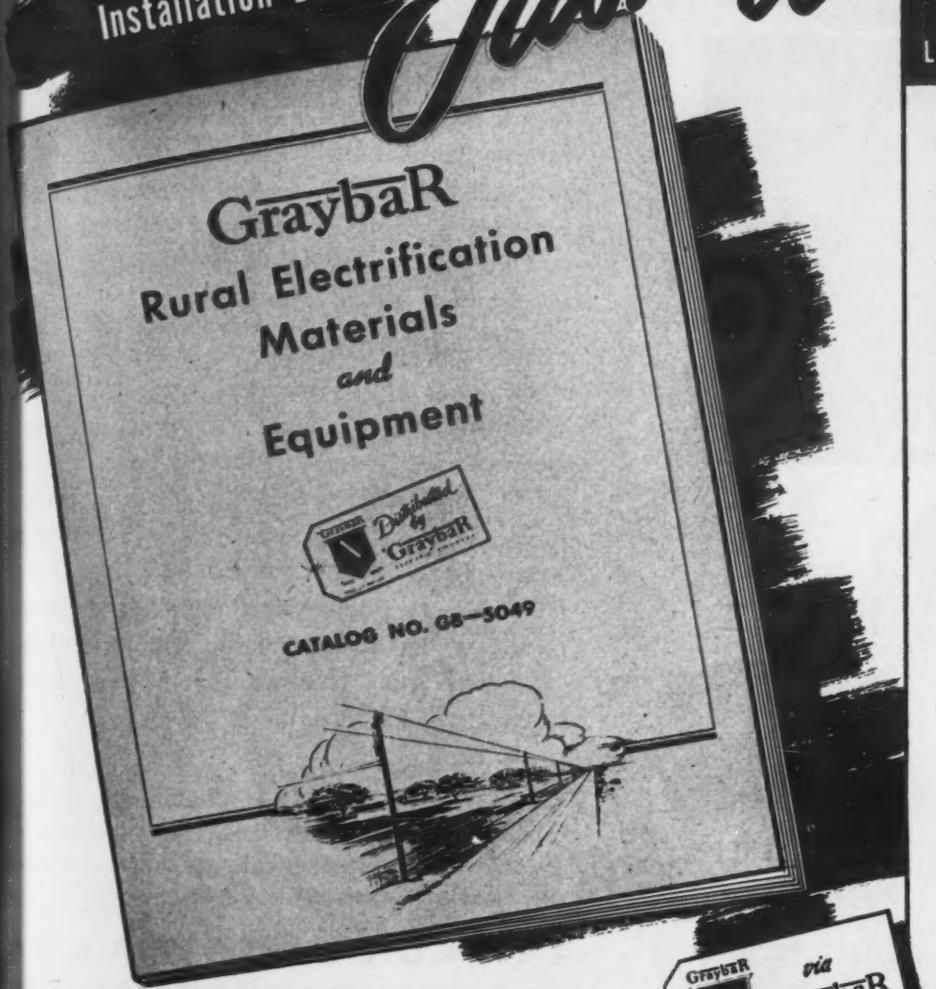
OKONITE

INSULATED WIRES AND CABLES

3760

TIME-SAVING BUYING GUIDE With Valuable Installation Data

Just off the Press



Up-to-the-minute LISTINGS ON THESE ITEMS

Anchors . . . . Conductors . . . . Connectors . . . . Crossarms . . . . Hardware . . . . Hot Line Safety Equipment and Tools . . . . Insulators . . . . Line Construction Tools and Equipment . . . . List of Materials and Symbol Index . . . . Material Schedule Charts . . . . Meters . . . . Nicopress . . . . Pole Markers . . . . Poles . . . . Reclosures . . . . Rural Line Schedule Drawings . . . . Staples . . . . Strand . . . . Sub-station Equipment . . . . Tap Clamps . . . . Transformers, Cutouts, Arresters . . . . Twist Sleeves . . . . Voltage Regulators . . . . Wiring Supplies.

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"Controlled drive fit needed her

make that tolerance .00025!

Driving turbine buckets into place on the wheel. Very close fit of buckets in their formed slot insures permanent tightness.

The fitting of turbine buckets is an exacting operation. Anything other than a permanent tight fit in the disc slot would result in vibration and eventual bucket failure. So Elliott engineers dictate a very close tolerance and special gauges for this detail. Pretty close work, and requiring real skill, but essential to the kind of performance expected of an Elliott turbine. This is the opinion of Elliott engineers, based on their many years of turbine-building experience.

The entire Elliott turbine is built with the same seasoned engineering judgment applied to dimensions, tolerances, materials, production methods, and other engineering features which affect ultimate performance. Certain design features are perhaps better than they need to be for small turbines, but many users want a turbine that needs no pampering, that will give uninterrupted service under any reasonable conditions (and some pretty unreasonable). They get such service from Elliott turbines.

●

The booklet about these turbines will give you very interesting factual evidence and data. It is valuable to have on file, even though you may not immediately need turbines. Write for a copy.

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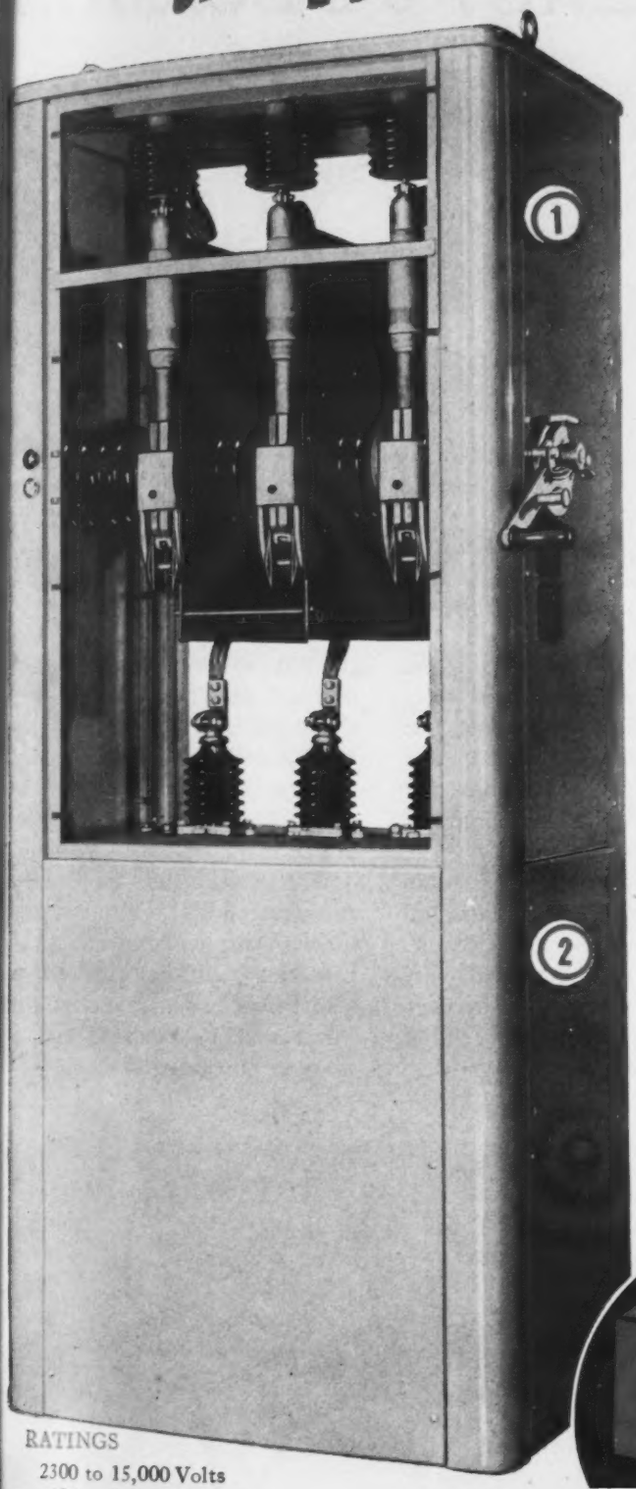
ELLIOTT TURBINES

for Mechanical Drive

CHECK the FACTS on DISTRIBUTION CIRCUIT

Interrupters



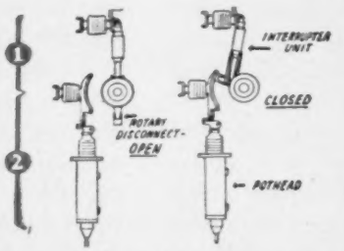
RATINGS
2300 to 15,000 Volts
200 and 400 Amperes

APPLICATIONS—

- In combination with fuses, to provide an economical means of fault protection and isolation for maintenance.
- To isolate transformer banks, instead of oil switches or expensive circuit breakers.
- For transfer or removal of load on energized distribution circuits.
- As a sectionalizing switch in feeder circuits.
- As an ordinary disconnect to provide safety in case of operating error.
- For interrupting exciting load currents of feeder regulators and capacitors.
- For changing transformer connections, star to delta or vice-versa without opening primary feeder.

CONSTRUCTION—

- Sturdy all-welded steel housings.
- All porcelain insulation.
- Floor, wall rack or transformer mounting.
- Available with conduit, through bushing, stud or pothead connections.



Arcs quenched in interrupter unit chamber when current is interrupted—then rotary disconnect establishes open gap.

R&IE

INTERRUPTER SWITCHES

RAILWAY AND INDUSTRIAL ENGINEERING CO.
GREENSBURG, PA. In Canada, Eastern Power Devices, Ltd., Toronto

The Check List

CONDUCTOR SUPPORTS, CLAMPS AND FITTINGS

DISCONNECTING SWITCHES
INDOOR AND OUTDOOR

AIR BREAK SWITCHES

INTERRUPTER SWITCHES

CUTOUTS AND THERMO-RUPTERS

SWITCH OPERATING MECHANISMS

SUBSTATIONS

OPEN OR ENCLOSED, ISOLATED PHASE HEAVY DUTY BUSES

KIRK INTERLOCK SYSTEMS

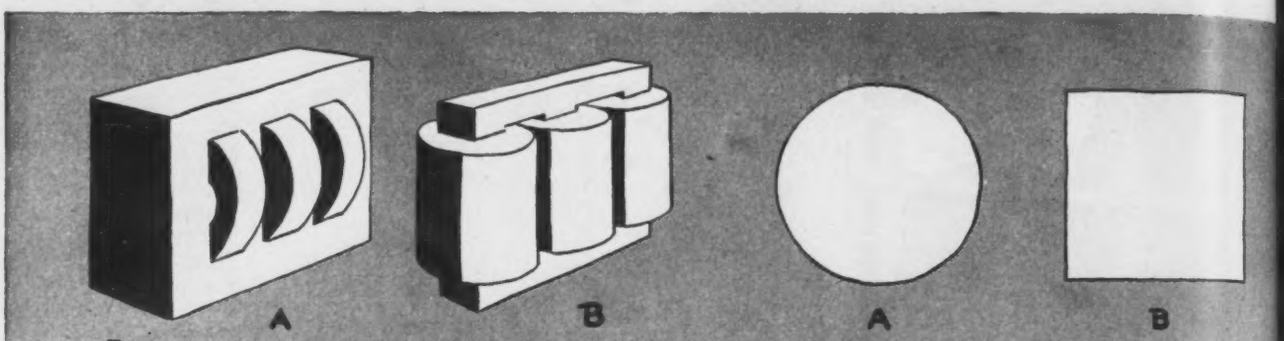
AUTOMATIC SECTIONALIZING EQUIPMENT

METAL CUBICLES

TESTING DEVICES

How Would You Desig

AT LEAST 6 DECISION



1 Would you use (A) shell type, or (B) core type construction?

2 Would you use (A) circular coil construction, or (B) rectangular coils?

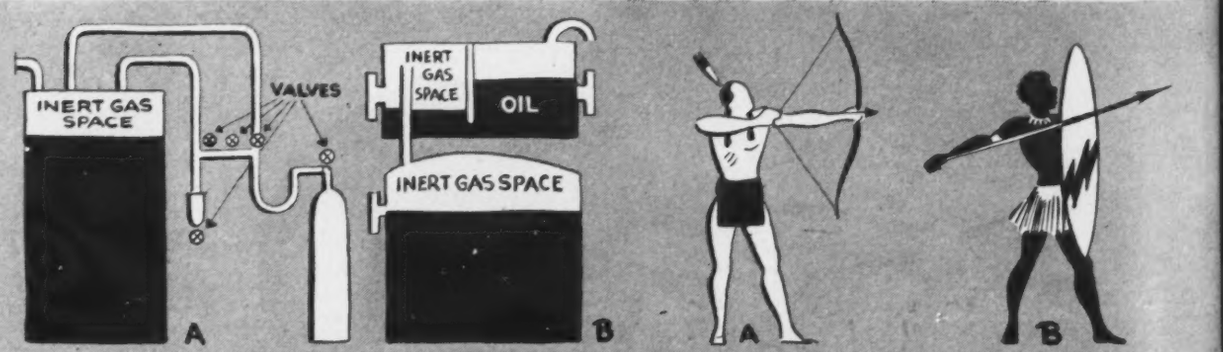
1 FOR SMALL, moderate voltage and moderate size transformers, core type construction is simple and economical. For large, high voltage transformers, however, the shell type construction has definite superior voltage characteristics and inherent electrical and mechanical strength. Allis-Chalmers makes *both* types of transformer. The decision on which to build for your needs is based on the application of sound engineering principles.

2 A CONDUCTOR carrying an electric current around a magnetic field tends to assume the form of a circle. Therefore, you would probably design your coil circular to avoid deformation stresses in operation.

Allis-Chalmers uses circular coils on all power transformers for this reason, and also because circular coils can be wound with uniform tension. Conductors need not be pounded into shape around sharp corners.

3 YOU WOULD probably put the no-load tap changer handle in the most convenient and least hazardous zone — at the side of the transformer. This is where Allis-Chalmers places all no-load tap changer operating handles.

Tap positions can be read from the ground . . . without coming near to high voltage bushings. Location at the side of the transformer also makes it more convenient to operate the tap changer handle.

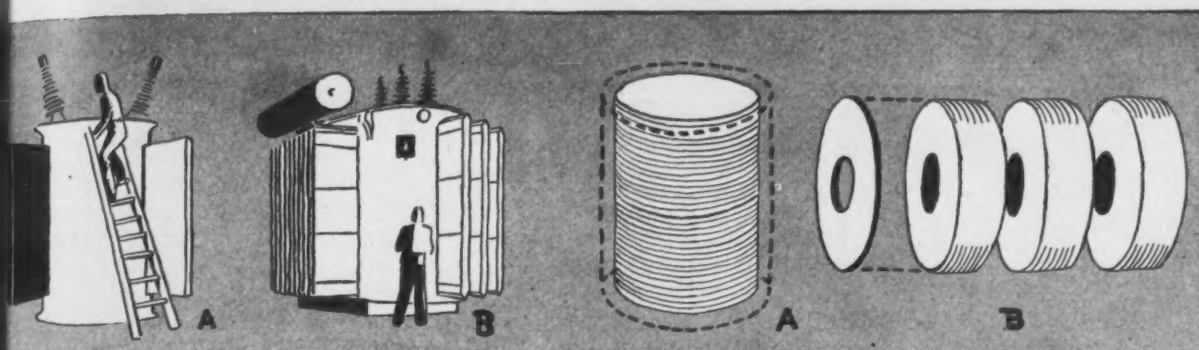


5 Would you regulate inert gas with (A) high pressure valve system, or (B) with an oil-sealed system?

6 If you employed load-ratio control, for tap changing under load, would you use the quick-break principle (A) or the slow-break principle (B)?

Power Transformer?

MAY BE INVOLVED . . .



3 Would you place the no-load tap changer ndle (A) on the cover of the transformer, or at the side of the transformer?

4 Would you (A) shield the entire winding, or (B) obtain uniform voltage distribution through overall transformer design and use a shield over just the first coil?

3 THE AMOUNT of shielding eeded would depend on the haracteristics of the transformer. lowever, the greater the portion f winding shielded, the greater the dynamic stress between hield and winding.

The Allis-Chalmers shell type esign inherently has uniform oltage distribution characteristics, and therefore it is possible use a shield over the first coil nly. Greater reliability and simicity of construction result.

5 REDUCING pressure from 2000 pounds in an inert gas tank to the 5-10 pounds required over the oil in the transformer involves the use of complicated valve mechanisms.

The oil-sealed system, on the other hand, has no moving parts, high pressure tanks, or valves — yet it provides full inert gas protection.

Thus an oil-sealed inert gas system, as offered by Allis-Chalmers, would be the logical choice.

6 IF YOU added the advantages of load-ratio-control to your transformer, you would probably employ quick-break design — which contrasts in principle with slow-break as shooting an arrow contrasts with throwing a spear. High speed contact separation shortens arcing time, reduces burning, lengthens contact life.

Get the full story on power transformers from our nearby district office. ALLIS-CHALMERS, MILWAUKEE 1, WIS. A 1777

Invest in

ALLIS-CHALMERS

Power Transformers

"Something To Write Home About"

U. S. Signal Corps Photo

TIREX SELENIUM Rubber Armor
Unequalled for Long Life Toughness and Resistance to Abrasion

Somewhere in Europe:
"I have seen Simplex wire and cable aboard several different airplanes in which I have flown."

New Guinea:
"During my travels I have seen lots of Simplex wire. It is all over the world. Everywhere I see reels of it."

Africa:
"I take great pride in using Simplex material because I know the effort all the gang back at Simplex use to make it the best."

Italy:
"I have seen a great deal of Simplex products in different campaigns over here. Without this equipment, a hard job would have been much harder."

England:
"I have seen plenty of Simplex wires here."

Alaska:
"All of us service men would like nothing better than to give our whole support to help you out back there at Simplex. We need the wire and cable."

Hawaii:
"Congratulations on the honors that have been bestowed on you. On one of the trips by ship I had the watch with earphones. I noticed the label on the cord said 'Simplex-TIREX.'"

Egypt:
"Here in the depot I get a chance to see many Simplex products, wire, cable and even throat microphones made at Sidney Street. Simplex products were at the Cairo Conference not so long ago. They do get around, don't they?"

Iran:
"The first thing I handled over here was 'TIREX' put out by 'The Simplex Wire and Cable Co. in Cambridge.'"

In the South Pacific:
"We are using a lot of your cable throughout our ships."

Wherever our fighting men have landed on foreign soil enormous quantities of Simplex-TIREX flexible cords and cables have gone ashore with them. They know it is good and they write home about it.

When you need a portable cord or cable to help along your war work — specify Simplex-TIREX.

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge 39, Mass.

ARMY E NAVY

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LINE LEAD—No. 6 B. & S. gauge stranded cable.

ARCING UNIT—Multiple gap type having high speed, heavy gauge electrodes assembled on steatite ceramic rod with steatite spacers. High quality, long lasting construction.

CHARACTERISTIC ELEMENT—Oxidized Silicon Carbide crystals which show no measurable deterioration after years of normal service.

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This rugged, non-deteriorating construction combined with their highly efficient operating characteristics have given Crystal Valves an enviable reputation under all operating conditions.

ELECTRIC SERVICE MANUFACTURING CO.
17th AND CAMBRIA STREETS, PHILADELPHIA 32

Sectional View of Typical Crystal Valve Lightning Arrester

CRYSTAL VALVE LIGHTNING ARRESTERS

LOWER

YOUR A-C TO D-C

LOSSES

WITH ALLIS-CHALMERS EXCITRON MERCURY ARC RECTIFIERS!

☛ Excitron alone among single-anode rectifiers gives you advantages of "continuous excitation".

☛ That means precision firing of anodes — no need for synchronizing ignition impulses with main anode voltage — sharply lower maintenance.

☛ Excitron's simple excitation circuit gives you current and voltage values which are easily measured and controlled. "Tuning" circuit to maintain proper wave shape not required.

☛ Stability of excitation is not affected by average single phase dips in a-c system voltage — because d-c for excitation is supplied from 3-phase source.

☛ Excitation anode in Allis-Chalmers Excitron is safe distance above mercury pool, not immersed as in other rectifiers. It cannot be affected by impurities nor by turbulence on mercury surface.

A 1719

How Excitron is Primed...

TO CLOSE EXCITATION circuit, plunger beneath mercury surface shoots jet up to excitation anode. Position of anode not critical; external adjustments unnecessary.

When mercury jet collapses, small d-c pilot arc remains to keep tube "primed".

Allis-Chalmers engineers *introduced* mercury arc rectifiers to U. S. industry. Today, consider Excitrons for all power conversion from 250 v up. Allis-Chalmers, Milwaukee 1, Wisconsin.

* * *

Hear Boston Symphony, Blue Network, Saturday evenings.

ALLIS-CHALMERS EXCITRON MERCURY ARC RECTIFIERS

The things that REALLY COUNT in station insulators can never be specified

Any number of different individuals can build station insulators and come out with the same size, shape and general appearance; and the insulators, when new, will have comparable physical and electrical properties. These things are covered by standards to which all manufacturers adhere...But there's still a big difference in these insulators--a difference measured by the relative skill of men and refinement of methods--a difference that isn't evident at first, but that shows up years later...In O-B switch and bus insulators, you get these things; a background of the longest and most extensive service records of the entire insulator industry. Thousands of O-B units have passed their 30th year in service. Carrying on in this tradition is a plant equipped and manned to make even a better product today...You can specify certain physical characteristics of a new station insulator, but you can't specify how much a man must know to make it, or how willing he is to apply that knowledge diligently. Nor can you specify how well the insulator will perform in service, or how long. This is all up to manufacturer...O-B gladly stands on its past record in offering station insulators to the electrical industry. Specify them on your next construction.

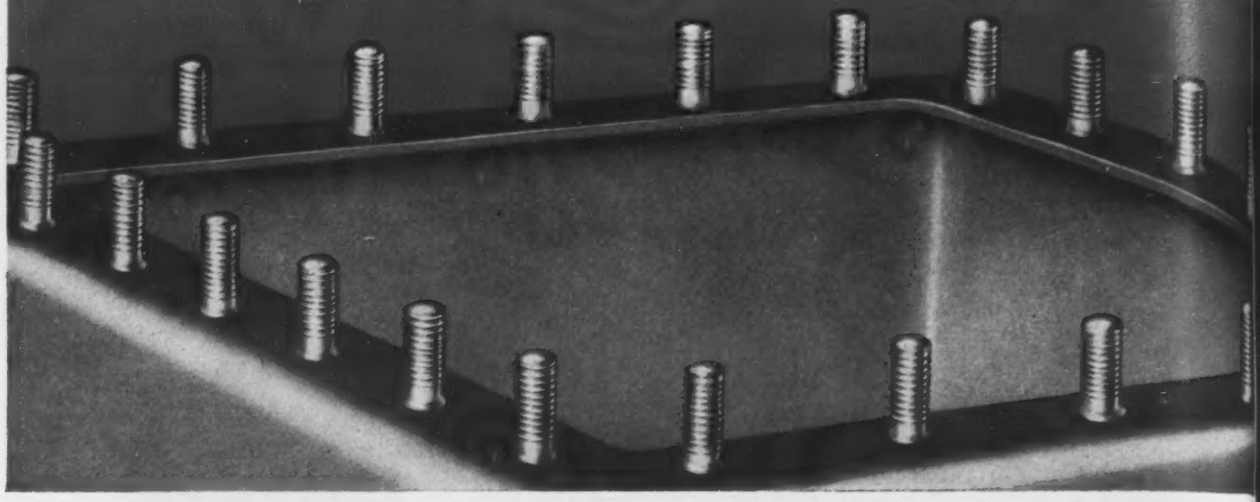
Ohio Brass

MANSFIELD, OHIO, U. S. A.

2487-H

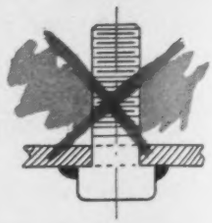
CANADIAN OHIO BRASS COMPANY, LIMITED,
NIAGARA FALLS, ONTARIO

How to automatically end-weld studs . . .



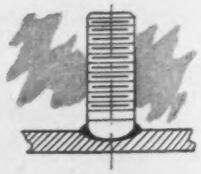
DON'T!

Don't waste both time and material using bolts for studs. Drilling holes, placing the bolt, and hand welding is wasteful. Why do all this when a method saving up to 75% of your time and material cost will produce work that is more accurate, stronger, and leak proof. *Here's the way Nelson Stud Welding will help you:*



DO!

Do use Nelson Stud Welding, because no holes need be drilled . . . it's all done in one operation *automatically!* Complete fusion between stud and metal is made easily and quickly. And the weld is stronger than the strength of the stud. Used today in more than 400 industrial plants in the United States and Canada, the Nelson Stud Welder may be operated either manually or as a production unit.



SEE US AT THE METAL CONGRESS OCTOBER 16

WRITE TO: **NELSON SPECIALTY WELDING EQUIPMENT CORP.**
Dept. EW, 440 Peralta Avenue, San Leandro, Calif.

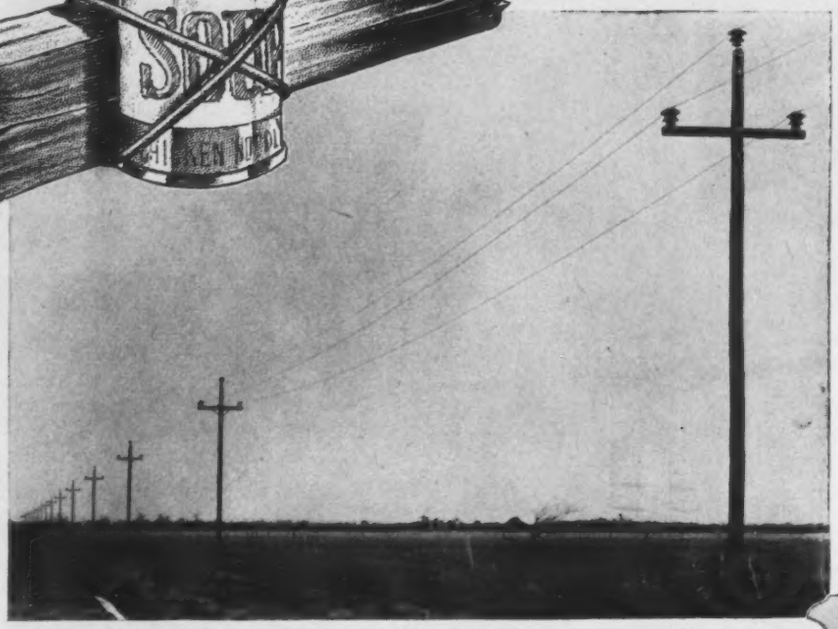
Eastern Representative: Camden Stud Welding Corp. Dept. 22, 1416 So. Sixth St., Camden, N. J.

The Model "H" Stud Welder

NELSON STUD WELDERS & STUDS

Sketched from an authentic case on a rural power line.

YOU CAN BUILD LINES THIS WAY, BUT...



...TO BUILD LINES THAT STAY BUILT RELY ON O-B PINTYPE INSULATION

Insulators can play a big part in building lines that require little or no attention. With a single insulating unit between potential and ground, and often without shielding, pintype insulators must be individually perfect--and must stay that way!..Consider this fact the next time you specify pintypes. They may be small, their voltage may be relatively low, and they may be "out in the sticks" where their job isn't spectacular, but no piece of insulation needs to be better made than a pintype if it is to be trouble-free...For many years O-B has recognized this necessity and put great stress on the manufacturing refinements which go toward producing such a pintype insulator. A generation of un-equalled service records is proof of accomplishment...Insulate your next pintype line with O-B.

BACK THE ATTACK · BUY MORE WAR BONDS ·

2488-H

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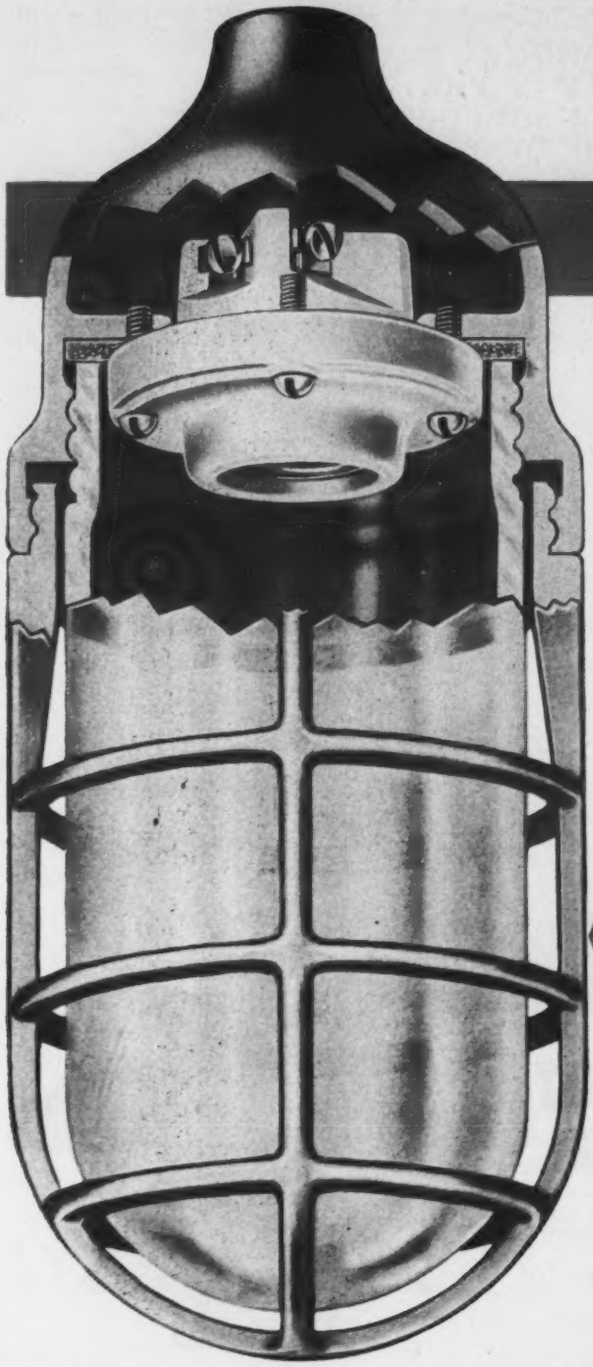
MANSFIELD, OHIO

CANADIAN OHIO BRASS CO., LTD., NIAGARA FALLS, ONT.



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Industrial Lighting
CONDULETS

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Screw guard or clamp guard types.

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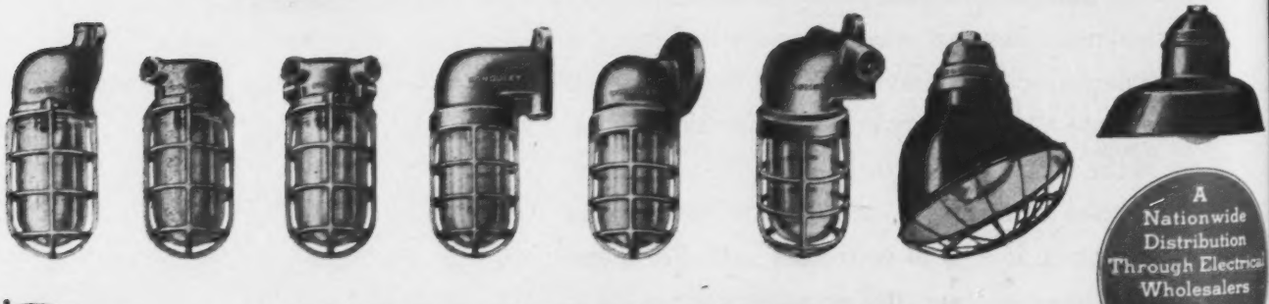
4 Reflector styles.

Accessories: colored globes, guards, half shades, adapters.

4 Sizes: 50 through 500-Watt.

Other ***Vaportight*** lighting fixtures are available for attachment to many round-base Condulets and sheet steel outlet boxes. Crouse-Hinds complete ***Vaportight*** line includes hand lamps, switches, plug receptacles, and other electrical devices.



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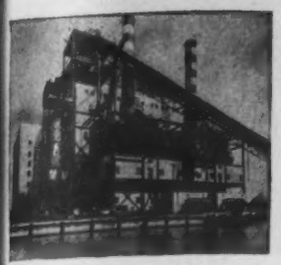
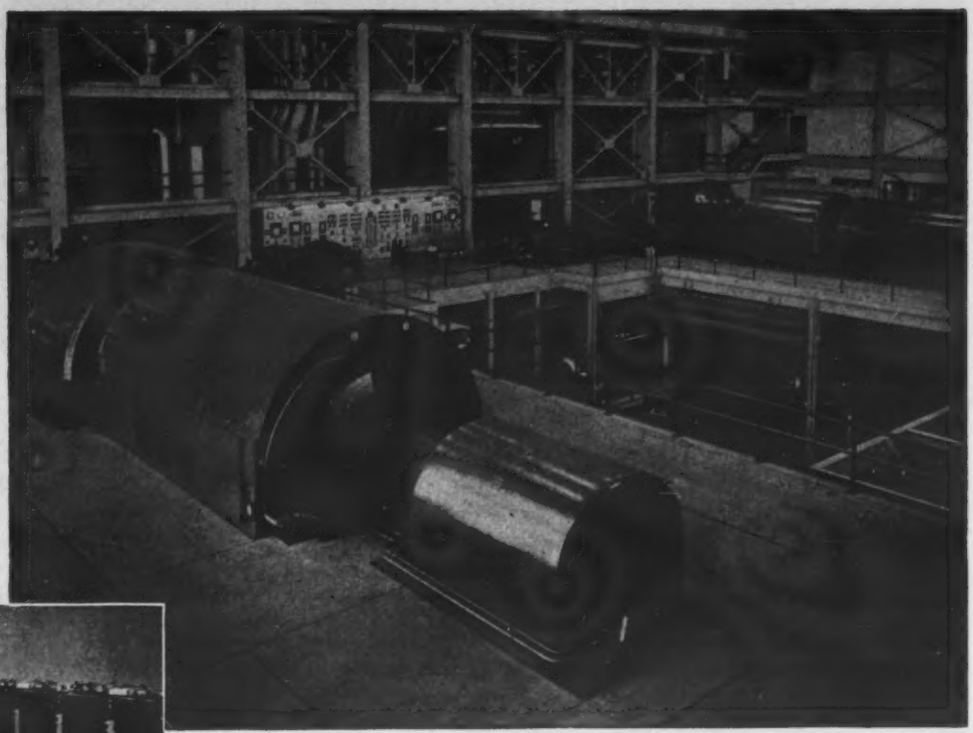
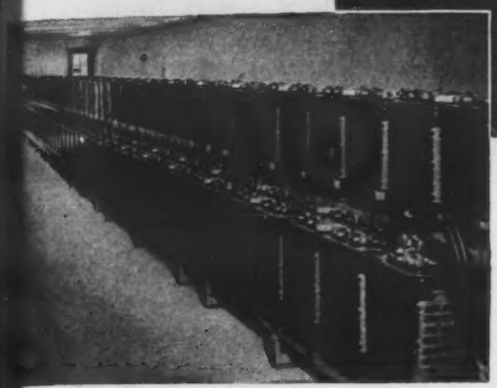


Riverside Electric Generating Plant, Baltimore's newest power station, was designed and constructed by Company personnel.





Baltimore's New Power Station is Equipped with Exide Batteries

This is the new Riverside Plant of the Consolidated Gas Electric Light and Power Company of Baltimore, the last unit of which began commercial operation in April of this year. In layout, construction and equipment it represents the latest and best that modern engineering has to offer. The main generators have a rated capacity of 50,000 kilowatts each, with an ability to generate 60,000 kilowatts continuously.

The Riverside Substation is the terminus of the second 220,000-volt line from Safe Harbor. It is also the feed point of the eastern end of the 110,000-volt ring that surrounds Baltimore. The switch yard controls 33,000 volt ties with surrounding areas, and with the new units in the generating station through step-up transformers.

And on the long battery rack at Riverside are scores of Exides, ready to respond instantly when needed. Exide Batteries have earned the confidence of engineers everywhere, and their widespread use in public utilities and private industrial plants is proof of their dependability, long-life, and ease of maintenance. When you buy an Exide, you *Buy to Last.* Take care of it and *Save to Win.*

ARMY E NAVY

Exide BATTERIES

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32
Exide Batteries of Canada, Limited, Toronto

ENGINEERING RESEARCH EXPERIENCE

Manufactured in 400 to 1200 Ampere Ratings - 5 to 34.5 kv Inclusive.

THESE FACTORS HAVE KEPT DELTA-STAR INDOOR DISCONNECTING SWITCHES OUT IN FRONT FOR OVER THIRTY YEARS.

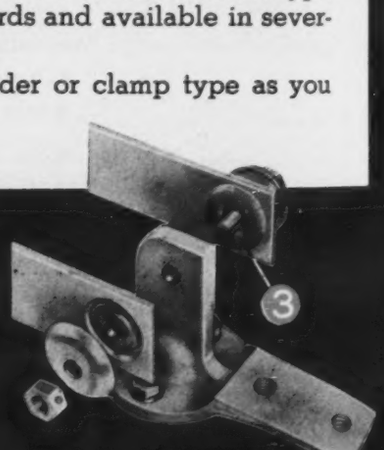
Overall dimensions have not changed but the switch parts and porcelain insulator units incorporate every desirable characteristic dictated by good modern engineering practice.

CONSIDER THESE FEATURES

1. Double Blade Tongue-Type Construction.
2. High Pressure Line-Type Contacts – with floating blades. Pressure is equally distributed by a single bolt passing thru slot in tongue. With blade closed, insulators are effectively tied together to resist short circuit stresses.
3. Line Pressure Annular Ring Type Hinge – contacts wipe clean as blade moves.
4. Positive Bolt-Type Lock – effectively prevents opening under short circuit stress.
5. Insulator Units – modern cemented insert type meet NEMA standards and available in several strength classes.
6. Terminal Lugs – solder or clamp type as you desire.

CONTACT ASSEMBLY
Line Pressure - Tongue Type

HIGH PRESSURE LINE CONTACTS



HINGE ASSEMBLY
Line Pressure - Annular Ring Type

DELTA-STAR ELECTRIC COMPANY

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The *Stake* of the United States in Expanding World Trade

WITH the war in Europe racing to a climax, and with a sure pattern for the defeat of Japan already outlined, American business is confronted with the need for an immediate decision on long-term economic policy.

What is this country's foreign trade program to be after the war?

No intelligent appraisal of all the factors any longer can allow us to postpone considering the issue merely because, in the past, foreign trade absorbed barely eight per cent of our production.

Actually, a whole new set of conditions was injected into the picture by the first World War; but we persisted in ignoring these new factors.

Almost overnight, the United States was transformed from the largest debtor nation in the world to the second largest creditor nation. At the same time, we made faster technological progress than any other nation. Thus we created the need for more dollar exchange on the part of the rest of the world and simultaneously made it harder for other nations to earn dollars.

Today, as another, far vaster war is approaching its end, those changed circumstances are magnified. America has new responsibilities—to itself, and to the world.

Our war-inflated industrial capacity cannot be allowed to drop back to prewar levels without causing a domestic crisis which we dare not permit.

And, because so much of the world is geared to the American industrial machine, we can no longer contemplate calmly the repercussions of a largely self-sufficient trade program or of an unplanned foreign trade program. Either would inevitably set the stage for the next world war.

☆ ☆ ☆

If we are going to prepare ourselves intelligently to cope with this new problem, we must acknowledge certain basic principles.

World trade cannot be rebuilt simply by attempting to restore *prewar* flows of goods. The war has so completely changed the economic fiber of many countries that it is necessary to develop *new* trade relationships. The East Indies, for example, may find the demand for their rubber considerably reduced; the United States may, to a large extent, have to cease exporting cotton; Japan will need to find new substitutes for much of its exports of silk; the British will need new markets to replace the income which they formerly derived from their large overseas investments.

We cannot expand markets for our goods, at home or abroad, unless we find ways of buying more supplies from more people at home or abroad, so that they will have more dollars to spend.

And we probably cannot create increasing buying power abroad without first exporting more of our technical skills—our engineers, our production and management men—to build new markets for our own specialties.

☆ ☆ ☆

What is needed to rebuild the world's economic system?

1. Most basic of all, of course, are stable governments which command popular support. In the absence of strong governments, currency stability cannot be achieved.

2. Most war-stricken countries, for a year or two, will need rehabilitation loans, because they will require far more raw materials, equipment, and live stock than they can pay for out of current production.

3. Loans, however, are only a stop-gap, though often a necessary one. Far more important than rehabilitation loans will be the creation of better opportunities for war-stricken countries to sell to the rest of the world, particularly to the United States, South America, South Africa, and India. The ravages of war do not completely destroy the ability of a country to sell. Indeed, it is surprising what large supplies of certain commodities war-torn countries have on hand even before devastated industries have been restored. The invading troops in Normandy found shoes almost non-existent, but they found food more plentiful than in Britain.

   Better opportunities for war-stricken countries to sell would create opportunities for them to buy the things they will require to restore scattered industries and depleted farms, and would help those countries to get rid of the exchange controls which are now universal. So long as a country is able to expand its exports only slowly and painfully, and is dependent upon foreign loans to prevent the depreciation of its currency, so long will it carefully preserve exchange controls and other restrictions in imports. That is why large advances, either through an International Monetary Fund or an International Investment Bank, can make only limited contribution to the removal of trade restrictions.

4. Permanent monetary and credit arrangements are needed to protect nations against temporary pressure upon their currencies, to permit necessary changes in exchange rates to be made in an orderly manner, and to assure that governments never again will repeat the "beggar-my-neighbor" policies of 1931 and 1932.

5. Finally, the world needs a reversal of the trend toward economic self-sufficiency, which received a strong impetus from the first World War and an even stronger one from the great depression of the Thirties. This does not mean that the efforts of many raw-material producing countries to diversify their industries should be opposed. During the late Nineteenth Century and the first part of

this century, the international specialization of production was carried too far, with the result that many countries became dependent for a large part of their standard of living upon the export of one or two raw materials—coffee, sugar, rubber, silk, wheat, wool, and meat. Between the two World Wars, however, the pendulum swung much too far in the direction of self-sufficiency. Some densely populated industrial countries of Europe (Italy, France, and Germany) even attempted to become self-sufficient in wheat, fats, and sugar. So limited are the natural resources and technical skills of most countries that each one finds many things which it can produce only at prohibitive costs. Between the extreme specialization of the late Nineteenth Century and the more recent trend toward extreme self-sufficiency, a happy medium should be sought.

☆ ☆ ☆

What role should the United States play in reconstructing the world's international economic system?

There are those who suggest that the United States be a more or less permanent Santa Claus. They believe that an excess of exports could be financed only by "loans"—loans that would eventually turn into gifts, after producing bitter controversy over why the "debtor" country did not meet its obligations. The persons who assert that full employment can be provided only by an excess of exports are in effect saying that our economy cannot become self-supporting. That is a confession of economic defeatism which a young and vigorous nation should not be willing to make.

The most immediate contribution which the United States can make to world reconstruction is to make itself prosperous.

Prosperity here means a large demand by our industries for imports. The more we import, the easier will it be for foreign countries to meet their large and urgent needs for goods. In 1939, with a gross national product of $100 billion, our imports were $3 billion. After the war, with 55 million people employed and a gross national product of $155 billion, our imports would be about $7 billion or $8 billion.

Not only should the United States make itself prosperous, but it should *keep* itself prosperous. *So important is the United States in the world economy that a depression here is bound to produce a disastrous drop in the price of raw materials throughout the world and to throw most countries into an economic tailspin.*

The United States should support the principle of a large fund to protect the exchanges of the world from temporary pressure. We should not permit differences over the details to prevent its establishment in ample time to be available during the critical period when war-stricken countries will need goods far in excess of their immediate ability to pay for them. *Some* arrangement, even though imperfect in details, will be infinitely superior to no arrangement.

Finally, the United States should take the lead in breaking down barriers to trade. We are the logical country to do this, partly because of our immense domestic market, and partly because for most of the last twenty-five years this country has been able to sell other countries more goods than they have been able to sell to us. One of the greatest contributions which the United States could make to a sound and expanding world economy would be to bring our imports, as soon as practicable, up to our exports. *In other words, the United States, in the long run, should be hard to borrow from but easy to sell to.* The United States should implement this policy (1) by continuing the negotiation of reciprocal reductions in duty, and (2) by accepting exchange rates which make foreign currencies cheaper in dollars than they were in 1939. So great will be the world's need for goods that we can be sure that any dollar exchange earned by sales to us will be converted into American-made goods and will lead to larger exports.

Time was when the United States obtained about eight per cent of its standard of living by sending goods abroad and bringing back other goods. Before the war, however, we were getting less than five per cent of our living by international trade. If, after the war, we were gradually to raise the proportion of our standard of living obtained by trading with other countries to ten per cent of domestic production, our imports would be about $15 billion or $16 billion a year. Our people would be able to buy many things which they now cannot afford, and scores of countries which export raw materials and luxury products would feel the stimulus of rapidly expanding markets. Their expanded demand for road building machinery, mining machinery, machine tools, agricultural implements, locomotives, railroad cars, electrical equipment, trucks, automobiles, and a multitude of products of our factories would create a million or more additional jobs in our factories.

Although the United States would raise its standard of living by increasing its imports and its exports, it should honestly face the fact that the resulting shifts in production and employment would temporarily be painful for some people. The increase in imports would be in commodities which other countries can produce for less than the cost at which much of our output is produced—such as sugar, wool, copper, some fats and oils, wines, winter vegetables and fruits. The increase in our exports would come from those industries in which our superiority is greatest—particularly the manufacturing industries. Finally it would be advantageous, to the country as a whole, to shift a million or two workers from agriculture, where they earn about 60 cents an hour at best, to manufacturing, where they earn better than 80 cents an hour.

☆ ☆ ☆

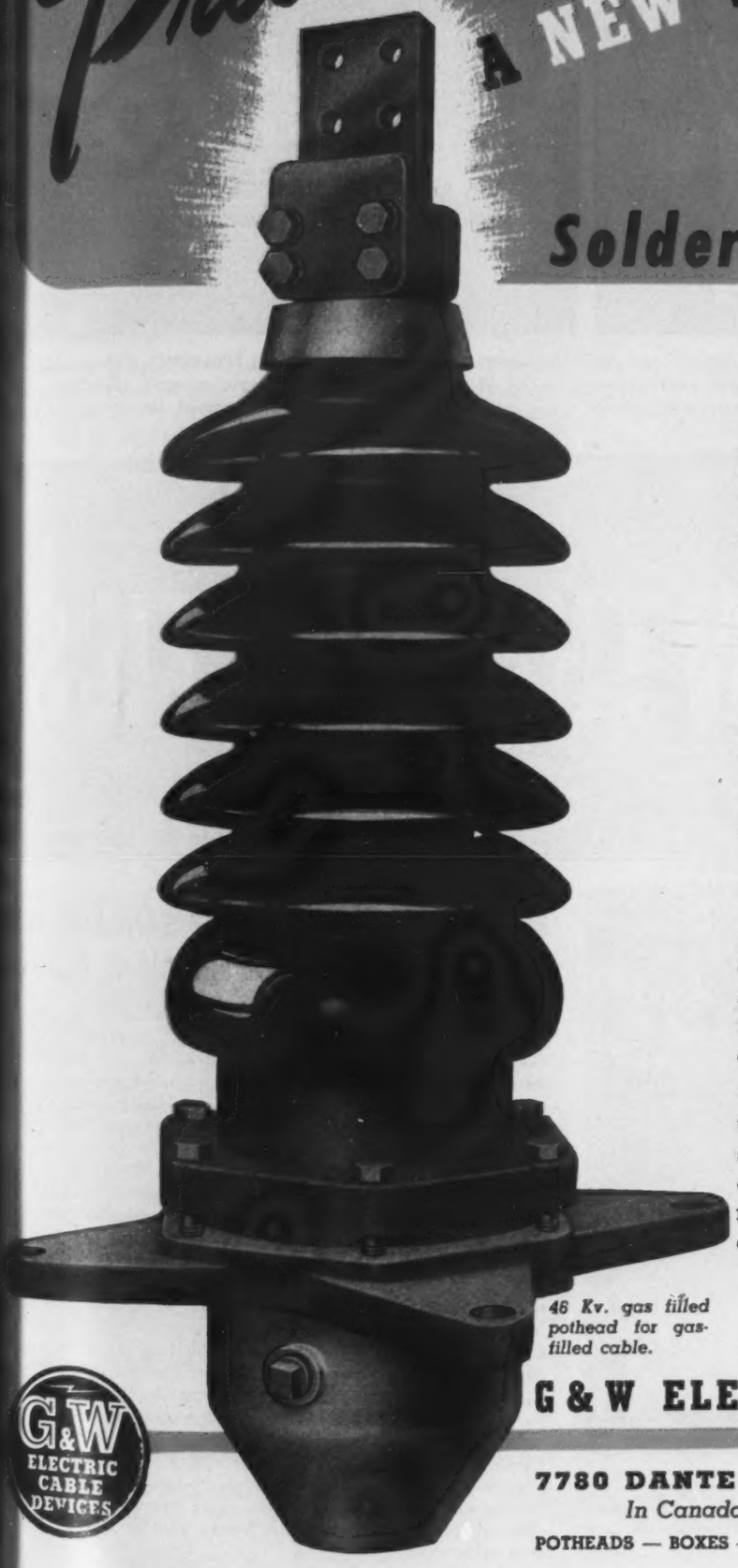
The very fact that in economic matters the rest of the world is dependent upon the United States, exposes our country to great demands and to envy and misunderstanding. The United States must be willing to help the rest of the world, but its help should take the form of assisting other countries to help themselves. Never in all history has one country had such an opportunity to give the world a rising standard of living, to foster conditions under which peace flourishes. What greater tragedy could there be than to make the sacrifices which we are now making and fail to seize this chance to create a world of hope and opportunity in which the spirit of goodwill among nations is able to flourish.

James H. McGraw, Jr.

President McGraw-Hill Publishing Company, Inc.

Presenting A NEW DEVELOPMENT

G&W POTHEADS *with* SPUN COPPER CAP AND WIPING SLEEVE *Soldered to Porcelain*



46 Kv. gas filled pothead for gas-filled cable.

A SUCCESSFUL METHOD OF SOLDERING METAL TO PORCELAIN HAS BEEN DEVELOPED BY G & W AFTER SEVERAL YEARS OF RESEARCH. SEVERAL HUNDRED G & W TYPE "ST" (Soldered Tight) POTHEADS HAVE BEEN INSTALLED AND ARE GIVING SATISFACTORY SERVICE UNDER A VARIETY OF OPERATING CONDITIONS. G & W's contributions to this field include improved design details on which patents have been applied for:

- Drawn copper cap and spun copper wiping sleeve eliminating possibility of leaks due to porous castings.
- Tapered shape of porcelain at soldered joints takes up temperature strains between metal and porcelain and provides extra mechanical strength.
- A relatively short ferrule within the copper cap replaces the usual long internal conductor connector lug and stem. This simplifies assembly and increases the internal creepage for a given external length of porcelain.
- The special form of wiping sleeve and the continuation of the external metallized surface on the porcelain makes possible a successful design of gas-filled pothead for gas-filled cable. Also, makes a better design for compound or oil-filled potheads.

Further data gladly sent on request.

G&W ELECTRIC CABLE DEVICES

G & W ELECTRIC SPECIALTY CO.

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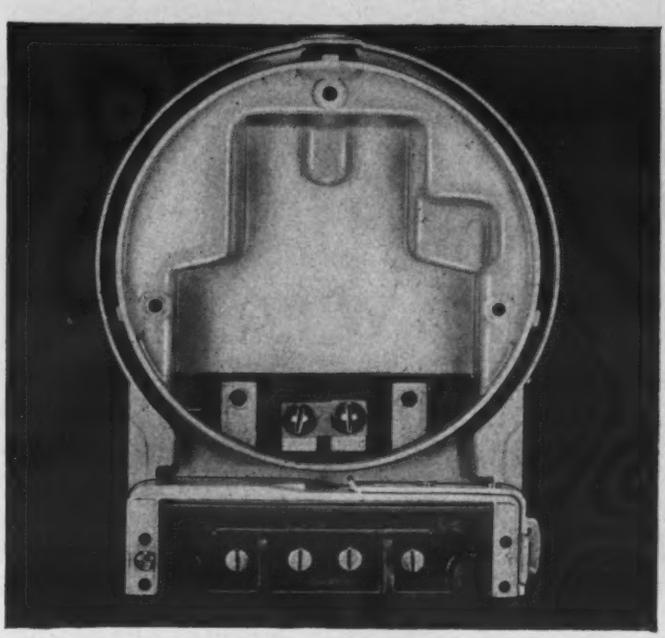
In Canada, Powerlite Devices, Ltd., Toronto

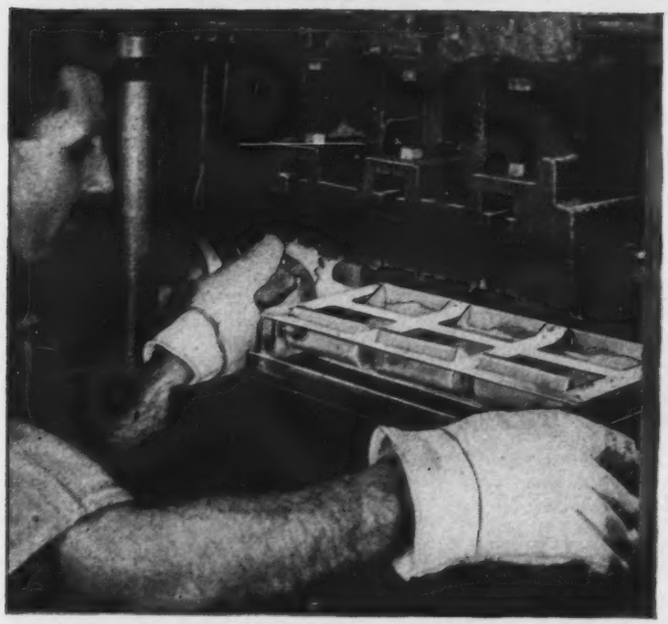
POTHEADS — BOXES — OIL FUSE CUTOUTS — SUBWAY OIL SWITCHES



(*Above*) **TERMINAL BLOCKS OF MOLDED MELMAC** are installed in the die cast aluminum base of all Sangamo single phase two and three wire watthour meters to eliminate possibility of block failures resulting from arc tracking.

(*Above*) **MELMAC'S UNUSUAL ELECTRICAL PROPERTIES,** high arc resistance (A.S.T.M. Avge. 130 sec.), dielectric strength (430 Volts/Mil) and heat resistance (300°F.) determined its choice for these Sangamo meters.

Life ON THE PLASTICS



(*Above*) **A 6-CAVITY DIE IS LOADED** with mineral-filled MELMAC molding compound ready to be molded into the filler-block for the Sangamo meter. MELMAC's strength, as well as electrical properties, are important in this use.

MELMAC 592 ADOPTED BY SANGAMO FOR ALL WATTHOUR METER TERMINAL BLOCKS

THE EXCEPTIONAL arc-tracking resistance of MELMAC* 592 has determined its selection by the Sangamo Electric Company for the insulation material to be used around the terminals in all single and polyphase watthour meters.

The installation of watthour meters in exposed locations subject to high voltage surges and lightning has increased the electrical stresses on the insulating materials used in their construction.

Extensive tests were made by the Sangamo Electric Company to find an insulating material with the right combination of properties in regard to strength and freedom from arc tracking. Cyanamid's mineral-filled MELMAC was found not only to eliminate the carbonization caused by arc-over but also to provide an atmosphere at elevated temperatures possessing arc-quenching properties.

During tests made in accordance with A. S. T. M. Standards, Cyanamid's MELMAC formaldehyde molding material showed an arc-tracking resistance in excess of 120 seconds (130 sec. average). Phenolic products, when measured by the same method, showed arc-tracking resistance rarely exceeding 5 or 10 sec.

The results of these tests demonstrated to the Sangamo Electric Company that the use of MELMAC would practically eliminate any terminal block failures which result from high-voltage surges or arc tracking. Therefore, MELMAC has now been adopted for use on all terminal blocks used in Sangamo watthour meters.

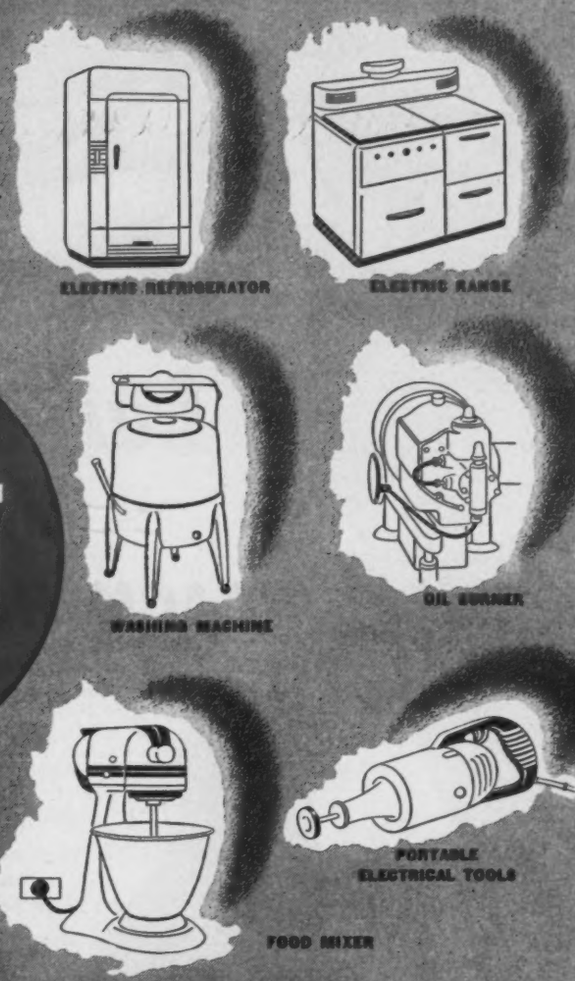
*Reg. U. S. Pat. Off.

(Above) **THE "A" BLOCK** for the Sangamo terminal block is molded of MELMAC in a 4-cavity die. MELMAC's excellent insulating properties are maintained under all extremes of temperature and humidity.

NEWSFRONT

(Above) **MELMAC FILLER-BLOCK AND "A" BLOCK ARE ASSEMBLED** into the terminal block for installation in the cast aluminum base of the Sangamo watthour base meter as shown above.

Cyanamid's mineral-filled MELMAC will find many new applications in electrical applications where arc-tracking resistance is of extreme importance. Its use in circuit breakers will make a major contribution to increased safety and service life. In switch plates, terminal blocks, connector plugs and other insulating parts for ranges, refrigerators, washing machines, power tools, which operate under varying conditions of dust, dirt, dampness and temperature, MELMAC's insulating properties, dielectric strength, heat resistance, and high arc resistance will also provide an added life and safety factor. Write for the manual, "MELMAC MOLDING COMPOUNDS".



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Even when used with wires as fine as #40 AWG, Lumarith gives protection due to the absence of electro-chemical decomposition—that built-in hazard of insulations containing an excess of water-soluble chemical salts. *Lumarith is entirely different chemically from paper, cotton and regenerated cellulose.*

Lumarith also provides an effective barrier to high humidity and moisture conditions, particularly important to the insulation of small relay coils operating at high voltages. Lumarith has a high softening point (146°—177° C depending on formulation).

Corrosion-resisting wrappers of Lumarith film and Lumarith molding powders in solutions for dipping, are high in dielectric and physical strength, low in moisture absorption. Films come in a special mat finish which increases visibility and decreases slippage in winding operatons.

Have you a copy of "Lumarith for the Electrical Industry"? It's well worth having on file. Celanese Celluloid Corporation, *a division of the Celanese Corporation of America*, 180 Madison Avenue, New York 16, N. Y.

LUMARITH

A Celanese Plastic*

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. . . for easier reconversion to peace loads— Westinghouse CSP Distribution Transformers

Because all apparatus needed for a distribution transformer installation is placed in one tank, the Westinghouse CSP can be moved in a fraction of the time and cost required to move an ordinary installation.

Westinghouse CSP Distribution Transformers ease the task of relocation. Completely Self Protecting (against lightning, short circuits and dangerous overloads), they offer *load adaptability* that will improve service continuity on the unpredictable loads in the days ahead. A signal light first warns of an overload, later the internal breaker trips if the overload continues and becomes dangerous. The maximum thermal capacity is *safely* usable at *all* times.

For complete information, call your Westinghouse office, or write for DD-46-100, Westinghouse Electric & Manufacturing Co., Dept. 7-N, East Pittsburgh, Pa.

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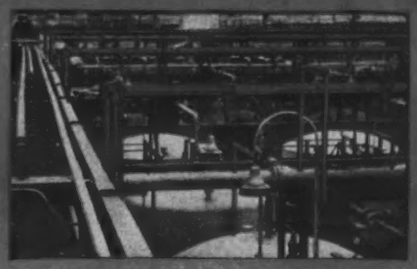
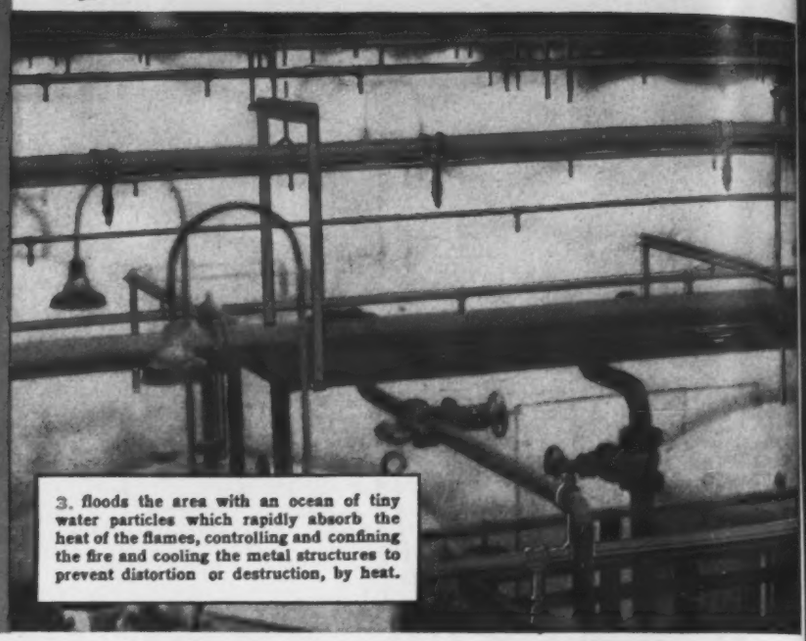
WAR DEPENDS ON RUBBER-

SYNTHETIC RUBBER depends on . . . WaterFOG



1. A leak permitting escape of highly flammable vapors from these huge butadiene and styrene production tanks . . . a spark . . . and the entire area of this important synthetic rubber plant would be threatened with destruction . . . EXCEPT FOR

2. . . . the fact that this synthetic rubber plant is protected by the most effective method of cooling and confining fires in highly flammable vapors or liquids. Release of WaterFOG (two systems going into operation in this picture) . . .



3. floods the area with an ocean of tiny water particles which rapidly absorb the heat of the flames, controlling and confining the fire and cooling the metal structures to prevent distortion or destruction, by heat.

Rockwood WaterFOG

strips flammable vapors of their threat

At one of the country's largest synthetic rubber plants, five WaterFOG systems — part of a completely engineered Rockwood fire protection system — stand watch over 34 huge processing and storage tanks. The tanks they guard, measuring 18½ feet high by 8 to 10½ feet in diameter, contain butadiene and styrene . . . extremely vulnerable in case of fire.

The WaterFOG systems may be operated simultaneously, separately, or in any combination. A WaterFOG curtain between every other row of tanks, goes into action whenever the system on either side starts operating. Thus protection is provided over, around and under every tank.

WaterFOG — created by impinging streams of water from Rockwood nozzles — is effective on flammable liquid or vapor fires where spray and solid streams are frequently unsafe. It absorbs heat faster, retards vaporization, doesn't splash. Both Underwriters' Laboratories and Associated Factory Mutuals approve Rockwood WaterFOG installations of fixed piping. WaterFOG nozzles for hose lines also available. Write for Bulletin 123.

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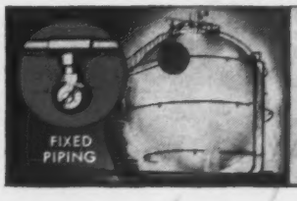
TYPICAL WaterFOG APPLICATIONS

transformers	oil storage
oil switches	regulators
generators	etc.
paint shops	

Water Engineered by Rockwood
Cools, Confines, Smothers Oil Fires

ROCKWOOD WaterFOG



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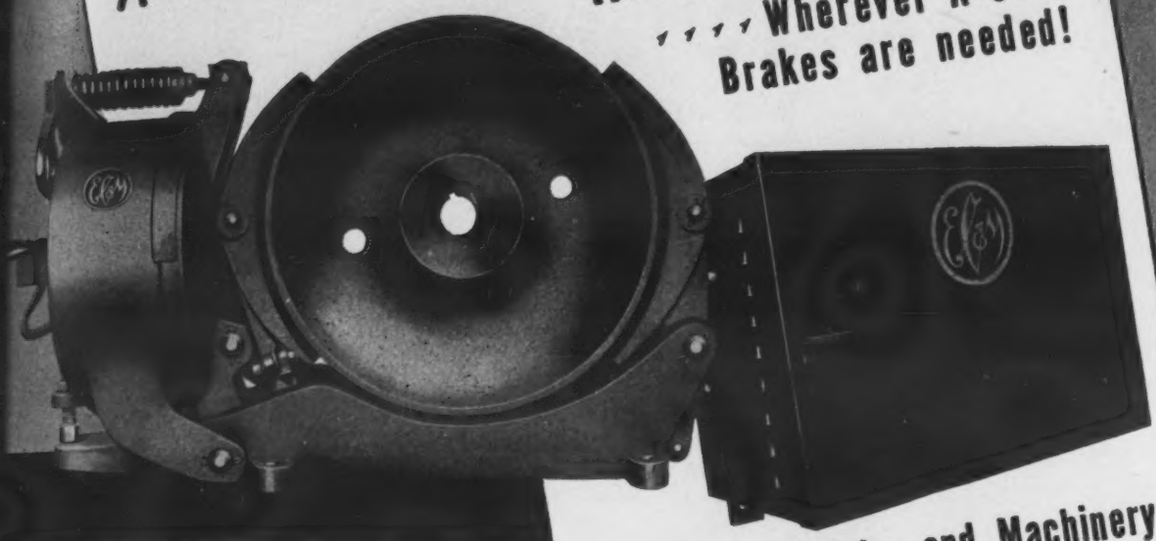

On Cranes, Hoists, and Machinery . . . these EC&M Type WB Brakes give HIGH-SPEED PERFORMANCE -REDUCED UP-KEEP

BY the addition of a compact rectifier-unit — available for separate mounting, as shown above, or combined with the motor control panel— you can now have as smooth, quick-acting and efficient brake performance on a-c motors as experienced for years on d-c motors.

These brakes not only eliminate the laminated members required in a-c brake design, but give quick response. High initial current insures *fast release;* automatic reduction of the holding current results in *fast setting.*

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No a-c chatter.
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No motors, gears or pumps.
Has fast release and fast set.
Has ability to permit accurate inching.
Has hand release.
Has solid cast-steel magnet and armature.
Has short armature-movement.
Has thick, moulded brake blocks— 1/4" to 3/4" thick.

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2698 EAST 79TH STREET CLEVELAND 4, OHIO

The BETTER

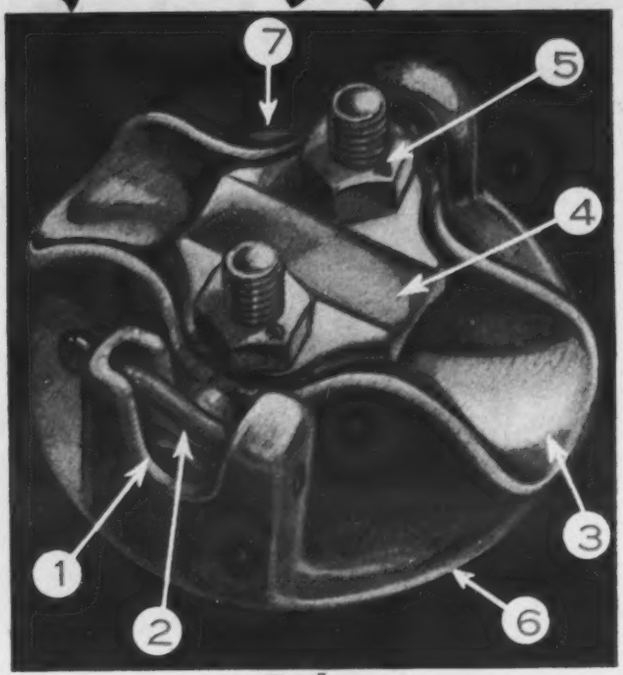
ORIGINATOR AND LARGEST MANUFACTURER OF WET-PROCESS PORCELAIN INSULATORS

LOCKE INSULATOR

FIRST IN CLAYRAMICS

Locke Clamp-Types

GIVE YOU THESE EXCLUSIVE ADVANTAGES



Eliminate Radio Interference

permanently. All metal parts are in initimate electrical contact at all times and under all conditions.

Conductors Are Protected

against burning. The heavy clamp mounting definitely keeps power arcs away from the easily damaged conductor.

No Loose Parts To Handle

in the air. The insulator minus the clamp is installed just as you would install any other pin type insulator. The clamp is attached loosely to the conductor on the ground. It is only necessary when installing the conductor to slide the clamp into its proper location, drop it into the mounting, drive home the cotter key and tighten the bolts.

No Special Tools

are required either to install or replace an insulator. Hot line maintenance is simple and fast using nothing but standard tools.

Other Valuable Features . . . .

1. High trunnion seat to permit maximum free clamp movement.
2. Heavy duty cotter key maintains electrical contact with the trunnion at all times. It cannot be completely removed, but is easily withdrawn to permit removal of clamp.
3. Wide, smooth bell mouth to eliminate conductor chafing.
4. Reversible keeper to accommodate maximum number of conductor sizes. Holds the conductor gently and firmly without danger of crystallization.
5. Special lock-nuts to prevent loosening of grip in service.
6. Overlapping cap protects cement joint from action of weather.
7. Smooth rounded edges to retard corona formation.

Only LOCKE clamp-types give you all these advantages

For nominal ratings from 34.5 KV to 69 KV, these better, time-saving units are available in either standard multipart or Hi-Top type.

Before you decide on the insulators for your next construction job, be sure to get all the details on Locke Clamp-Types.

FIFTY PROGRESSIVE YEARS OF SERVICE TO THE ELECTRICAL INDUSTRY

LOCKE CORPORATION BALTIMORE MARYLAND

FIRST IN CLAYRAMICS

*Keep your extinguishers in shape . . . FREE BOOK tells how!

WHEN fire breaks out, there's no time to repair or recharge extinguishers — they must be ready to hit the blaze fast! So the logical time to keep the equipment in fighting form is *before* the emergency . . . by systematic inspections at fixed intervals.

A method for setting up an extinguisher maintenance system in your organization is outlined in a booklet prepared by Walter Kidde & Company. It covers *all* types of equipment, tells exactly what to check on each type, how often to examine and recharge. It shows how extinguishers should be placed and marked, how records should be kept. This book "Inspection and Maintenance of First Aid Fire Extinguishers", will be sent you upon request. Write for your copy.

WALTER KIDDE & COMPANY, INC., 140 CEDAR STREET, NEW YORK 6, N.Y.

HOW ELECTRONIC HEAT NCREASED SPAR OUTPUT 700%

Here's How Tolerton Lumber Co. Met Increased Production Demands

EFORE December, 1941, wood aircraft manufacturers were using spars cut om solid wood planks. But the supply of rade A spruce for such spars was also nited. Thus spars laminated from thin eces came into the picture; next, to fur- er conserve lumber, short lengths were arf-jointed; and finally narrow widths ad to be edge-glued in order to meet emands.

As a result of these many operations, costs nd production time increased sharply.

The Tolerton Lumber Company, apply- g electronic heating to speed the setting the glue, found that edge-glued joints ould be "set" in 2 minutes; that 8 scarf ints could be "set" simultaneously—in out 10 minutes; and that a 6" x 6" x 16½' eam could be laminated from several lanks in about 20 minutes by electronic eat (former time in hot-platen press was hours).

The aircraft spars are cut from these 6½ foot beams.

Tolerton uses an RCA 15-kw electronic enerator.

Results:

1. Because electronic heating shortened ress time so greatly, the Tolerton plant utput was increased from 25 spars per ay to 200!

2. The setting of the glue is complete ecause electronic heating produces uni- orm temperature throughout the glue line.

3. Lumber costs were cut about 40% y using odd pieces!

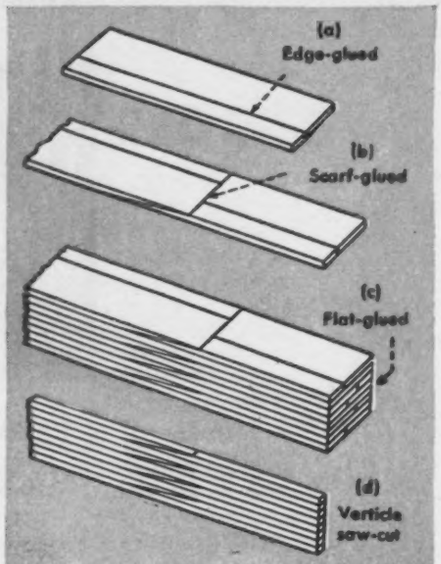
4. In tests of these glue joints, wood ailure runs 100%—considerably above the 80% acceptable under Government specifications.

For more complete information on this application, send the coupon below.

Other Applications by Tolerton: "In addition to manufacturing spars and other aircraft parts such as ailerons, fairings, fins, capstrips, etc., at a big saving in time, lumber, and expense," wrote Mr. R. I. Tolerton, vice-president of the Tolerton Company, "we are also using this electronic method of gluing in the manufacture of lithograph backing blocks and steelmill hammer boards.

"The manufacturing rate has increased greatly, and the products are more accurately made because of the added glue adhesion obtained by electronic heat. We also laminate 6-inch square maple blocks which are later turned to make wheel-bearings for bombers. Electronic heat has made these blocks the most satisfactory material yet found for the purpose."

Want More Details? The complete story of the Tolerton operation—together with pictures, drawings, diagrams, and curves—is contained in a free 8-page article "Electronic Heating Sets Glue in Laminated Aircraft Spars." Write for it, or send the convenient coupon. If you have a problem electronic heating might solve, write us the details; our engineers may be able to help you. Address Radio Corporation of America, Electronic Apparatus Section, (70-40F), Camden, N. J.



Steps in the construction of the spars: (a) edge-gluing to obtain 6-inch width, (b) scarf-gluing to obtain 16½-foot length, (c) laminating to obtain 6-inch by 6-inch by 16½-foot beam, (d) beam cut to obtain edge-grain laminated spars ¾ inch by 6 inches by 16½ feet.

RCA 15-B Electronic Power Generator which supplies about 50,000 B.T.U. per hour. (Send coupon for bulletin.)

RCA ELECTRONIC HEAT

BUY
WAR
BONDS

RADIO CORPORATION OF AMERICA

RCA VICTOR DIVISION · CAMDEN, N. J.

SEND FOR DETAILS! RCA, Electronic Apparatus Section, Camden, N. J.

Gentlemen: I want more information on how Tolerton Lumber Co. increased output 700% with electronic heat. Please send me "Electronic Heating Sets Glue in Laminated Aircraft Spars." Also booklet on the "RCA 15-B Electronic Power Generator."

☐ I would like an RCA sales representative to call.

Name.....

Address.....

Company.....

City.....State.....

70-40F

WORLD'S LARGEST

now at the half-way mark

ONLY 10 generators installed . . . yet Grand Coulee already produces over 800,000 kw. With *all* generators in operation, output will soar to 1,974,000 kw.—greatest of any hydro-electric plant in the world.

In every plant producing electrical energy, whether hydro or *steam,* Texaco gives the effective lubrication that assures top efficiency of generating equipment.

Texaco Regal Oils (R & O) a new high in preventing rust and oxidation—keep steam turbine systems clean, bearing temperatures normal, governor action smooth and sensitive. These oils free themselves rapidly from air and water, are highly resistant to gum formation and sludging.

Texaco lubricants have proved so effective in service they are definitely preferred in many fields, a few of which are listed at the right.

Texaco Lubrication Engineering Service is available to you through more than 2300 Texaco distributing points in the 48 States. The Texas Company, 135 E. 42nd St., New York 17, N. Y.

THEY PREFER TEXACO

★ *More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.*

★ *More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.*

★ *More locomotives and railroad cars in the U. S. are lubricated with Texaco than with any other brand.*

★ *More revenue airline miles in the U. S. are flown with Texaco than with any other brand.*

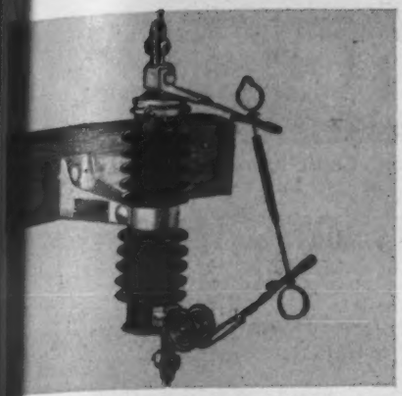
★ *More buses, more bus lines and more bus-miles are lubricated with Texaco than with any other brand.*

TEXACO

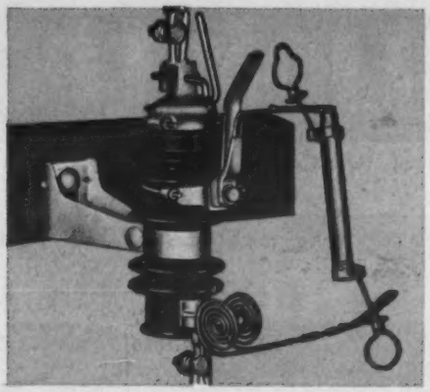
TEXACO Regal Oils (R&O)

FOR ALL TURBINES

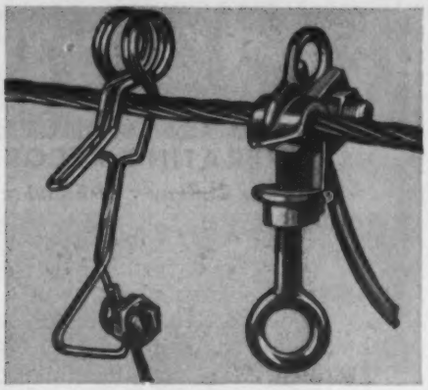
TUNE IN THE TEXACO STAR THEATRE EVERY SUNDAY NIGHT—CBS ★ HELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTLY



LOW MASS, extra-flexible switch parts mean high resistance to mechanical shock and heavy short-circuit rupturing capacity.



LIGHTNING STROKES dissipated through low resistance path to ground. Power follow-up interrupted within the horn fibre fuse tubes.



CLAMPS. There is a Kearney Con-nec-tap clamp for the most unusual load or construction problem. Made in many types for all wire sizes.

ELIMINATE CHARRED CARTRIDGES

All Kearney fuse links are designed to operate at full load well below the charring point of fibre —the material used as a liner in all cutout cartridges. You may have had failures of cutout cartridges on heavily loaded lines, but not if you are using Kearney fuse links. Or, your cutout cartridges may be operating on the ragged edge where there is not enough heat to cause actual charring, but quite enough to desiccate the tube to the point where the rupturing capacity of the cutout is greatly impaired.

In easier days when lines and fuse links were carrying only a fraction of their rated loads the temperature margin of safety was sufficient. With today's loads you are inviting certain trouble unless you know the operating temperature of your fuse links and cutouts at full load current. If you haven't investigated ask your supplier for this information or better still change to Kearney—the fuselinks with the low temperature characteristic. Your inquiry on this subject will be welcomed by Dept. "H."

JAMES R. KEARNEY CORPORATION,
4236 Clayton Ave., St. Louis 10, Missouri

LOW TEMPERATURE — POSITIVE — INTERCHANGEABLE

FUSE LINK PACKAGING is next in importance to electrical performance. Unless they are sufficiently protected against the rigors of transit, storeroom and field handling their precision types for naught.

KEARNEY ELECTRICAL PRODUCTS

12½ BILLION LB OF STEAM

OPERATING RECORD of two C-E Units at Westport Station, Consolidated Gas, Electric Light & Power Company of Baltimore.

CAPACITY (per unit)—285,000 lb per hr; **OPERATING PRESS.**—1325 psi; **TOTAL TEMP.**—

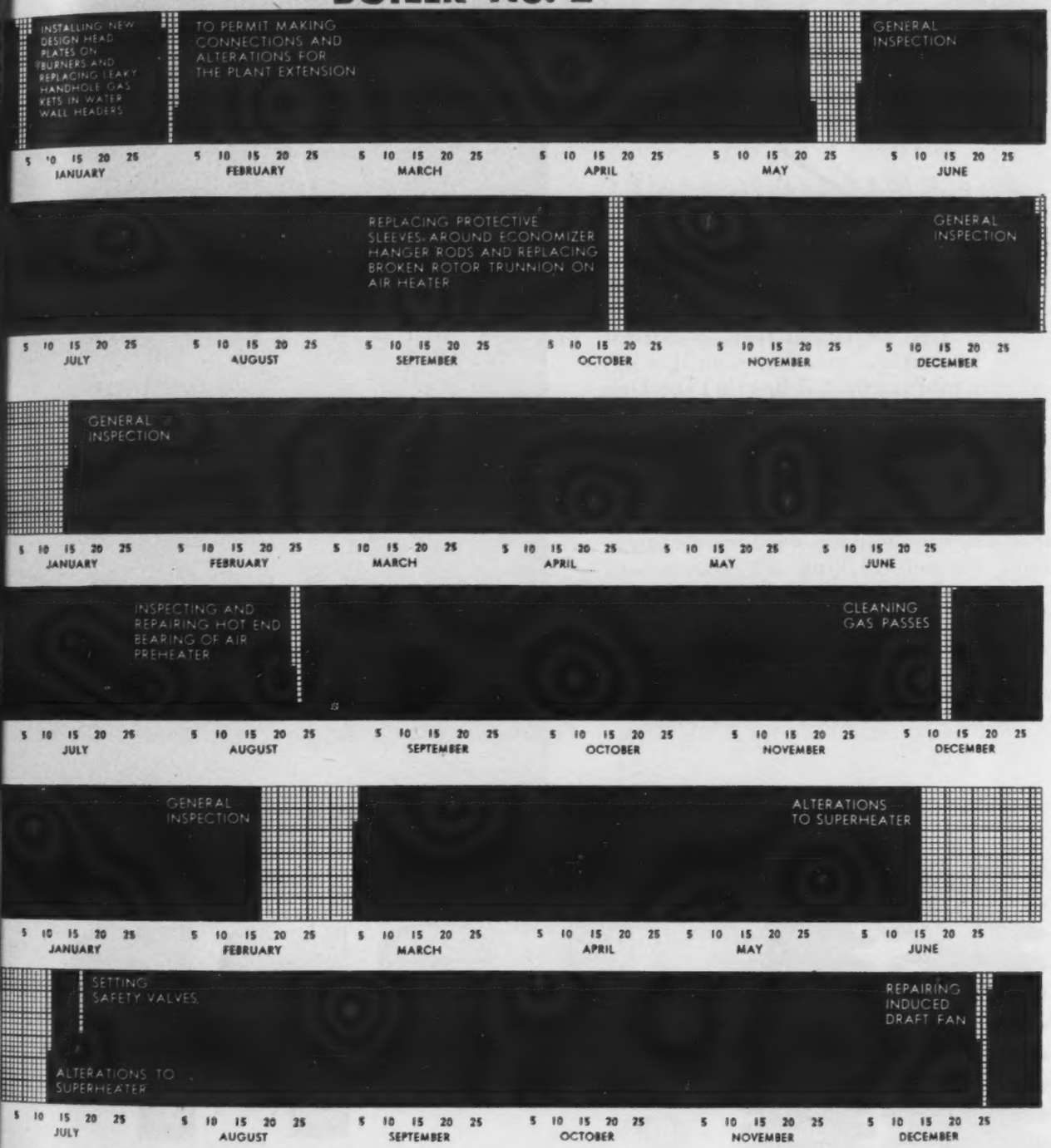
BOILER No. 1

COMBUSTION

C-E PRODUCTS INCLUDE ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR

3 YEARS OF WAR SERVICE

BOILER No. 2



COMBINED PERFORMANCE of both units—In service 92.5% of total hours in 3-year period. Averaged 91 2% of rated maximum continuous capacity for total hours in service over 3-year period. Availability, deducting time out for general plant inspection, 96.7%

ENGINEERING

00 MADISON AVENUE NEW YORK 16, N. Y.

C-E

HOW MANY MAN-HOURS PER-MILE-PER-YEAR FOR MAINTENANCE OF YOUR TRANSMISSION LINES?

In dollars-and-cents, transmission line patrol and maintenance is an important item in normal times. In wartime, man-hours on this job are even more critical. A line on Lapp Line Posts is a year-in-and-year-out economy on either count. Power arcover, stones or bullets, even severe enough to rip a couple of petticoats off, leaves these rugged posts with ample security to do their job. Fog-type design eliminates need for cleaning. Puncture and cracking are unknown in these units. The records on hundreds of installations, in notoriously tough areas, show that it's safe to eliminate most patrol cruises, and that insulators maintenance of all kinds is only a fraction of that on conventional high-voltage insulators.

LAPP LINE POST and STATION POSTS on your system offer . .

POWER ARCOVER. *Flashover and leakage distances are not appreciably lowered by damage —even loss of several petticoats.*

NO PUNCTURE. *Puncture path in Lapp Post design is as great as flashover path. Insulator will flash over rather than puncture.*

NO CRACKING. *One piece post body, not subject to bursting from tension strains created by thermal changes in nested parts.*

RADIO INTERFERENCE. *By virtue of design factors alone, radio interference is permanently prevented at rated neutral voltage.*

NO CLEANING. *Fog-type design preserves uniform leakage path, prevents leakage flashover, makes the unit "self-cleaning."*

MECHANICAL RUGGEDNESS. *Stones or bullets deflect off, or rupture petticoats, leaving post body intact and insulator secure.*

Lapp

LAPP INSULATOR COMPANY, INC., LE ROY, N. Y.

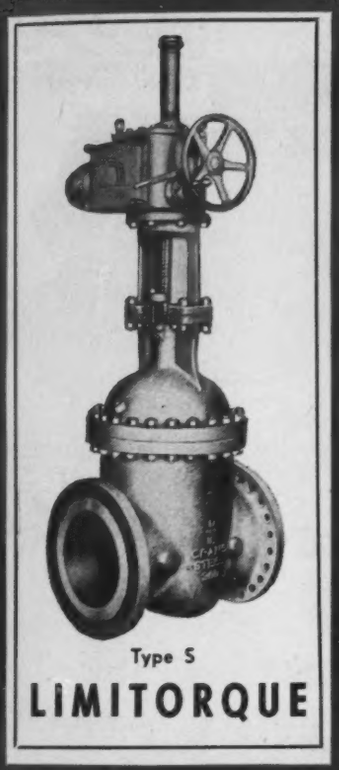
Ready..

ERY TIME THE BUTTON IS PUSHED

The unfailing dependability of LimiTorque Controls to function surely, instantly is proved over and over again every day in power plants and central stations all over the country.

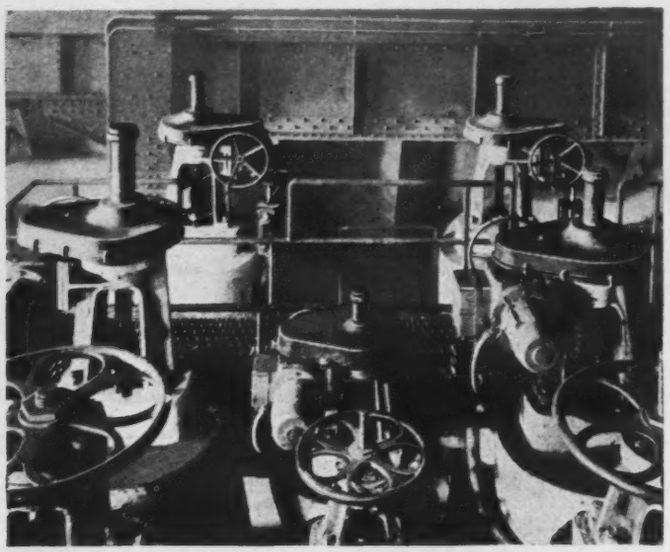
Whenever a button is pushed at either a centrally located master control panel or a convenient individual push button station, there is no uncertainty . . . the valve opens or closes as desired . . . quickly, safely.

Such reliability and simplicity makes remote operation of valves most practical, permits valves in all parts of the plant to be controlled from one central point, with a full knowledge of the status of the valves at all times.



Type S

LIMITORQUE



Part of a group of more than twenty LimiTorques operating steam and water line valves in a New England Generating Station.

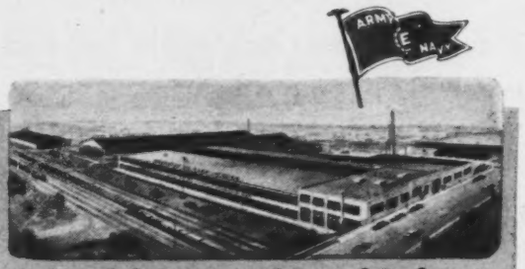
LimiTorque Valve Operators are made in several different types for varied applications on valves from 3" to 96" diameter. Floor stands can be supplied for mounting where direct installation on the valve yoke is impractical. LimiTorque fits all makes of valves and can be easily adapted to existing equipment.

Be sure to include LimiTorque in your post-war developments . . . write today for literature.

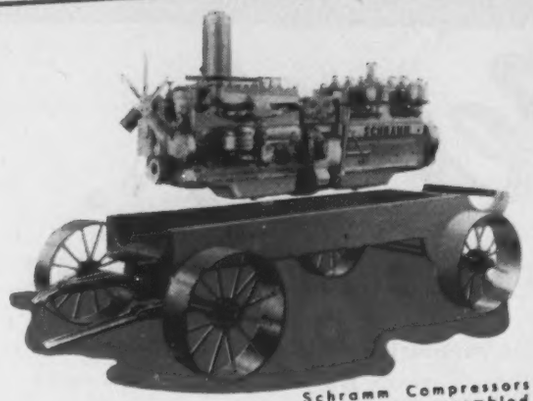
Philadelphia

GEAR WORKS INCORPORATED

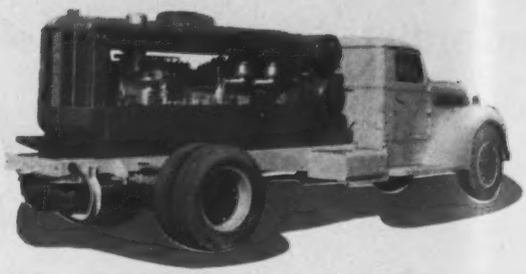
AVE. AND 6 ST., PHILADELPHIA 34, PA. NEW YORK • PITTSBURGH • CHICAGO



Industrial Gears and Speed Reducers
LimiTorque Valve Controls



Schramm Compressors and engines are assembled with built-in clutch, mounted in frame as a complete unit for lifetime alignment and vibrationless operation.



Wood skid mounting with cross members and bolts for attaching to truck chassis.

BUILT-IN MOTOR DRIVE mounted with cooling unit. Furnished with approved motor starting controls, ready to hook up and go to work.

DIESEL ENGINE DRIVE-IN LINE—A compact, easy-to-handle unit for permanent service . . . Radiator water cooling.

How to get Compressed Air *where you want it..*

IN THE FIELD
STEAM PLANT
GENERATING STATIONS

There are so many jobs where compressed air is needed by power companies — and into this versatile picture fits Schramm Air Compressors. Schramm units—both portable and stationary—are extensively used by the utility field in general field service—generating stations—steam plants —repair shops.

They are compact, lightweight, and easy to start merely by pushing a button.

And they have these distinctive "under-the-hood features: (1) completely water cooled to provide ideal performance both winter and summer (2) main bearings for every cylinder (3) mechanical intake valve (4) more cylinders and lighter parts (5) forced feed lubrication.

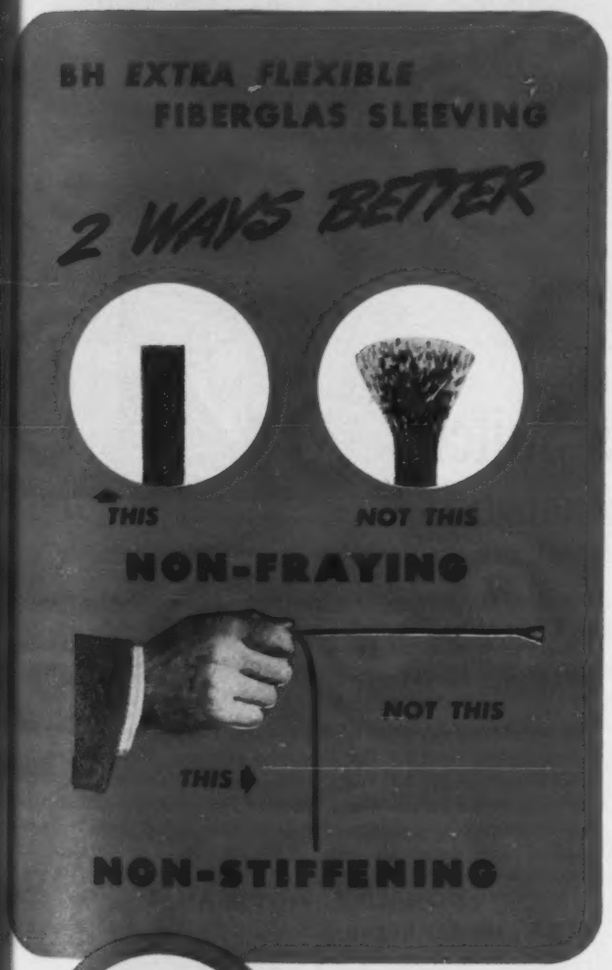
If you are not already using a Schramm, it will pay you to write today for illustrated bulletin AED-44

SCHRAMM INC.

THE COMPRESSOR PEOPLE
WEST CHESTER
PENNSYLVANIA

NO FRAYED ENDS
NO FRAYED NERVES

WHEN YOU USE BH FIBERGLAS SLEEVING!



Here's an Insulation that Handles Easier, Cuts Cleaner and Saves Time

IF you're exasperated by ordinary sleeving that frays on the ends, works stiffly and doesn't hold up in use . . . then you'll certainly want the low-down on BH *Extra Flexible* Fiberglas Sleeving! For this is a really *flexible* and definitely *non-fraying* sleeving—built around the excellent insulating qualities of Fiberglas by an *exclusive* BH process.

Fiberglas, you know, is moisture-resistant, high in dielectric and tensile strength and is shunned by fungus growths and unharmed by most chemicals. "Punishment" tests prove that BH *Extra Flexible* Fiberglas Sleeving has even more advantages. It is *permanently* non-fraying and non-stiffening. It won't burn because both yarns *and* impregnation are non-inflammable. And it lasts indefinitely without cracking or rotting.

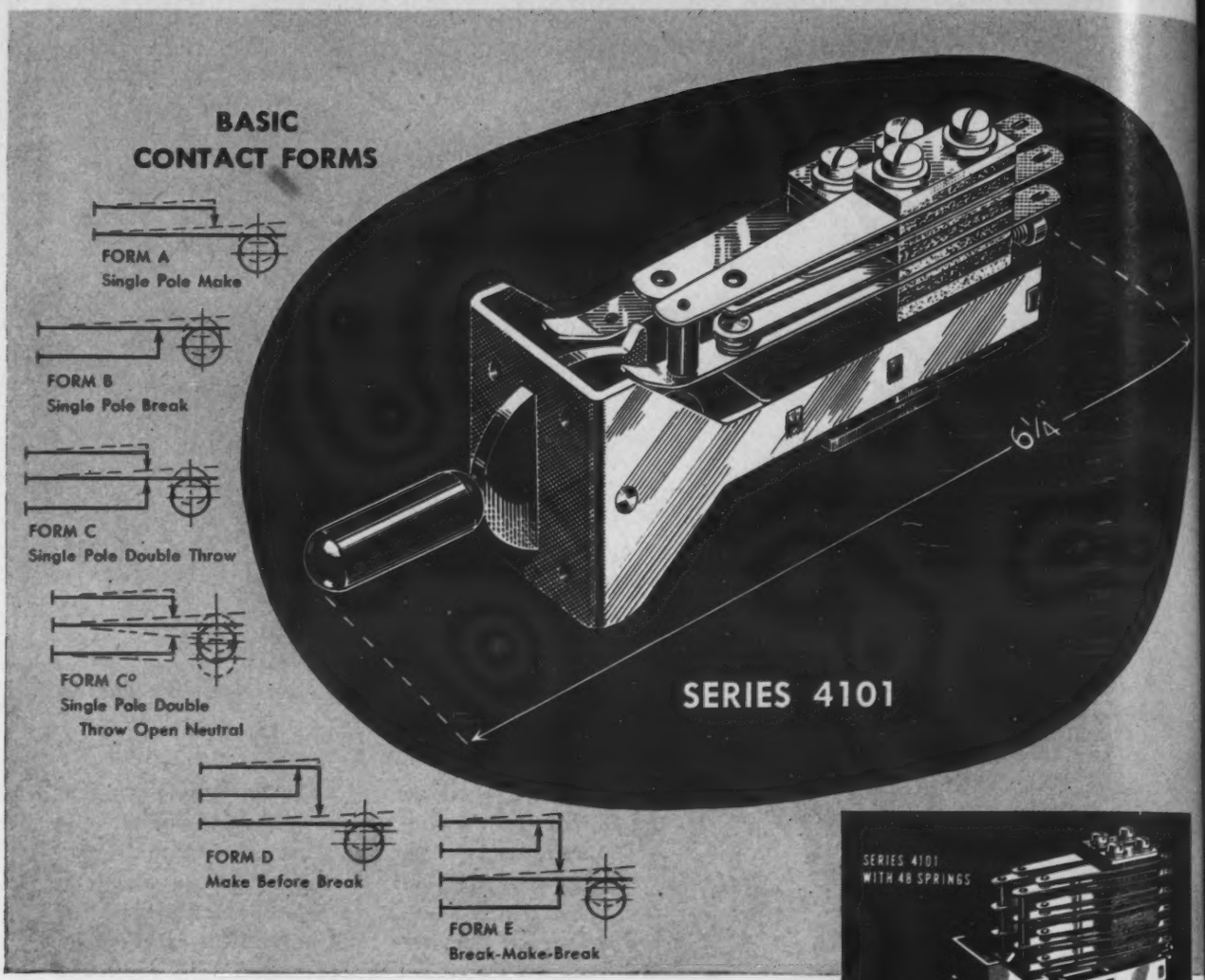
Assembly and repair men say BH *Extra Flexible* Fiberglas Sleeving is a pleasure to handle and a sure bet for long life in the most severe service. So why tolerate a less efficient sleeving any longer? BH is available in all standard colors and all sizes from No. 20 to ⅝", inclusive. Write for samples today and make your own comparison!

BH PRODUCTS

NON-BURNING IMPREGNATED MAGNETO WIRING · NON-BURNING FLEXIBLE VARNISHED TUBING · SATURATED AND NON-SATURATED SLEEVING

BENTLEY, HARRIS MANUFACTURING CO.

Dept. W Conshohocken, Penna.



Mossman Series 4101 HEAVY DUTY Lever Switch

PERMITS ALMOST UNLIMITED CIRCUIT ARRANGEMENTS

Utilities find the Mossman Series 4101 Heavy Duty Lever Switch permits a most versatile control set-up for such applications as:

1. Indication in remote control or telemetering circuits.
2. Supervisory control circuits in load dispatching.
3. Communication control circuits in utility and industrial plants.
4. Testing and calibration in meter departments and for tube testing.

Flexibility of circuit arrangements comes from the fact that the Mossman No. 4101 Heavy Duty Lever Switch makes use of any combination of the six basic contact forms shown here. This makes possible hundreds of combinations of contact arrangements.

Versatile use of the switch is further increased by the fact that it is available with as many as twelve springs per pile-up, 24 springs per position, or 48 springs total.

Rating of the 4101 switch with standard heavy duty contacts of 3/16" diameter, fine silver, is 10 amperes, 110 volts, a.c., non-inductive. With extra heavy duty contacts of 5/16" silver alloy the rating is 20 amperes. 110 volts, a.c., non-inductive. Breakdown rating of springs to ground is 2000 volts, a.c.

For complete description of the Mossman Series 4101 Heavy Duty Lever Switch send for the Mossman catalog. In it you will find information on the full line of Mossman precision electrical components. These include many types of heavy duty, multiple circuit lever switches, turn switches, push switches, plug jacks and other special switching components.

DONALD P. MOSSMAN, Inc.
612 North Michigan Avenue, Chicago 11, Illinois

MOSSMAN
"Electrical" Components

FWD TRUCK-POWER

Overcomes Handicaps of Manpower Shortage

This FWD established an enviable record for Los Angeles' Bureau of Power & Light, by restoring power after floods tore down transmission line towers.

MORE customers to serve . . . and more service per customer . . . with less man-power, restricted materials and limited equipment! . . . and still America's public utilities are coping successfully with these unprecedented service loads.

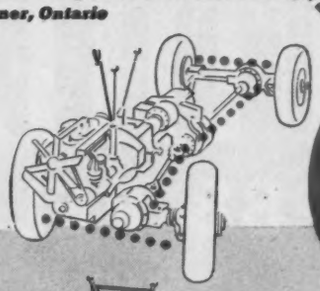
FWD truck-power is being employed by more than 150 utilities to help overcome handicaps of man-power shortage. Fleets of FWDs are proving that they have the ruggedness, four-wheel-power and traction to go "beyond the limit" of average contemplated service. Thousands of FWDs in utility duty are putting their "extra bit" into every emergency or routine duty to keep the pledge of public utilities in rendering service "as circumstances demand". In any weather, over any road, "more power" to the utilities that have built their service soundly around FWDs!

THE FOUR WHEEL DRIVE AUTO CO., Clintonville, Wisconsin

Canadian Factory: Kitchener, Ontario

Four-Wheel-Drive . . . THE BACKBONE OF RUGGED, DEPENDABLE TRUCK HAULING POWER

The true application of four-wheel-drive with center differential provides ability to get through under difficult conditions — increased surety and safety on the road — lower operating cost per ton-mile — long service life.



FWD TRUCKS

COMMERCIAL

CONSTRUCTION

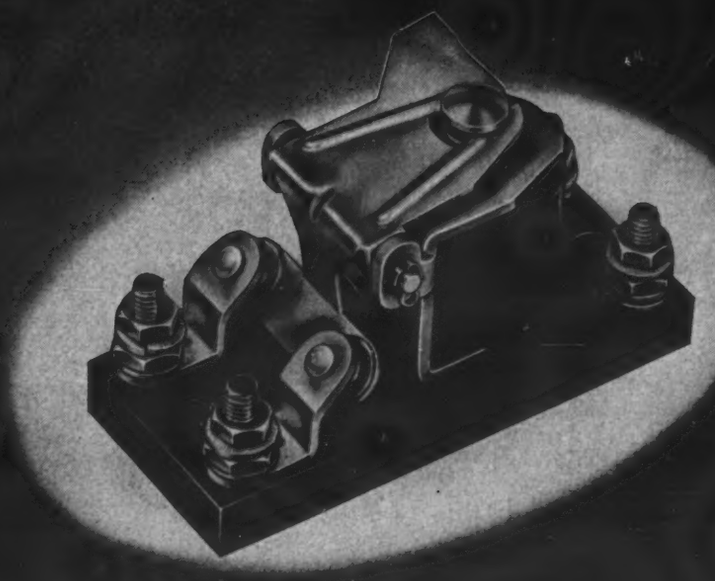
UTILITIES

OIL FIELDS

MILITARY

Trade-Mark of the Original and Exclusive Builders of Four-Wheel-Drive Trucks.

The PLUS Answer to B2A Specifications



EXTRA HEAVY-DUTY CONTACTS PROVIDE BIG

SAFETY FACTOR

A SHOCK-PROOF RELAY...THAT'S *Really* SHOCK-PROOF!

If your problem is one of finding a B2A relay on which the contacts stay open or stay closed unfailingly under the most severe conditions of shock and vibration, write for details on Struthers-Dunn Type 17AXX. Small in size, light in weight, it meets and exceeds all specifications for such services.

Struthers-Dunn Nutcracker Type 61HXX100 answers the need for suitable relays for extreme services particularly where severe overloads may cause trouble on units on which contacts have a less generous heavy-duty safety factor. Typical applications include such services as controlling aircraft landing lights, or controlling a number of solenoids simultaneously.

These relays are compact and sturdy, have double-break contacts, and meet the latest 94-32185D specifications with contact safety factor to spare. By a simple system of removable links, they may be converted to meet any one of the earlier 94-32185 or 94-32185A, B, or C specifications—or, they can be supplied in their universal type which enables you to make your own adaptation, quickly and easily for *any* of these specifications.

STRUTHERS-DUNN, INC., 1321 ARCH STREET, PHILADELPHIA 7, PA.

STRUTHERS-DUNN

5,288 RELAY TYPES

DISTRICT ENGINEERING OFFICES: ATLANTA · BALTIMORE · BOSTON · BUFFALO · CHICAGO · CINCINNATI · CLEVELAND
DALLAS · DENVER · DETROIT · HARTFORD · INDIANAPOLIS · LOS ANGELES · MINNEAPOLIS · MONTREAL
NEW YORK · PITTSBURGH · ST. LOUIS · SAN FRANCISCO · SEATTLE · SYRACUSE · TORONTO · WASHINGTON

ILLINOIS

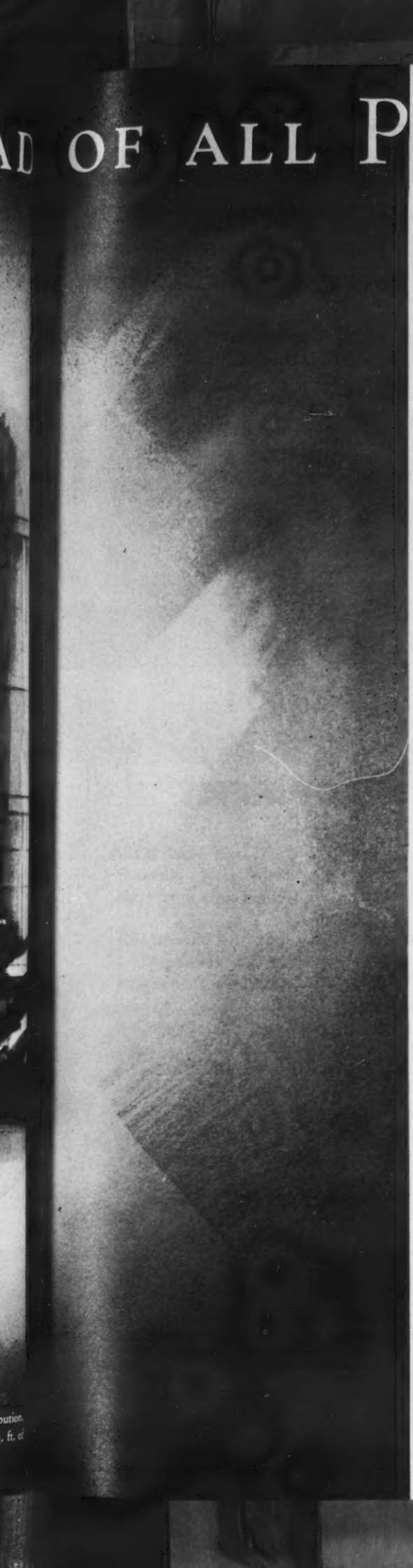
High Tension Gooseneck Porcelains for Transformer Entrance Wires

• Accuracy in control of production of ILLINOIS Porcelain assures exact dimensions plus high mechanical and high dielectric strength for perfectly balanced insulators. All sizes and shapes are available for high tension transformers of every type—ease of installation assured because of uniformity—right fit means dependable service.

ILLINOIS ELECTRIC PORCELAIN CO., *Macomb, Illinois*

RESEARCH...SPEARHEAD

The 80 practical specialists who work in this magnificent building at Bayonne, N. J., have every facility—chemical, physical, metallurgical—to aid them in bringing nearer their goal—extending to the utmost the effective means of electrical transmission and distribution. Built in 1941, the structure has already grown to 60,000 sq. ft. of floor space—is planned for further expansion as needed.



AD OF ALL PROGRESS...

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One-third smaller by volume and with half as many parts! That, in brief, is the story of a circuit breaker produced by a leading manufacturer, and made possible by use of silver-tungsten contacts utilizing the recently developed Stackpole "FW 41" formula.

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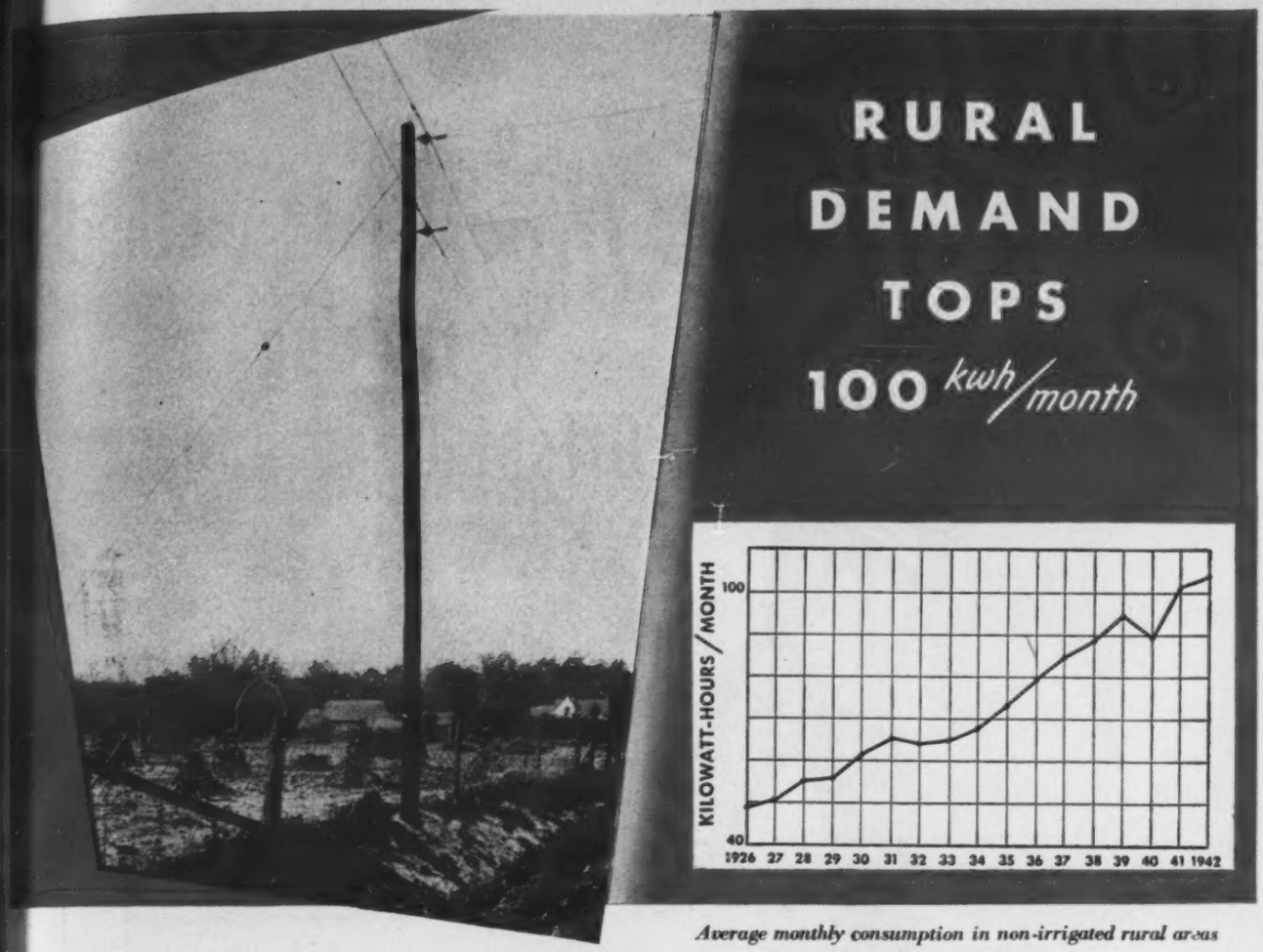

Average monthly consumption in non-irrigated rural areas

Climbing from less than fifty kilowatt-hours per month in 1926 to well over a hundred today, rural power consumption promises to hasten obsolescence of even the latter figure. For, included in that average are many young rural lines, whose customers have not been able to equip themselves with electrical appliances since the war began. Others are just becoming accustomed to having electrical help at hand.

Purchasers of Aluminum Cable Steel Reinforced will recall that Alcoa engineers have always preferred not to recommend conductors smaller than Number 4 A.C.S.R. Alcoa's supervisors, close to the feel of things in the field, prophesied that farm operators would adopt electrical help eagerly. Low conductivity wires would limit the power they could take from their lines.

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2. They can be installed on Pin, Strain or Spool insulators.
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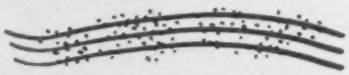
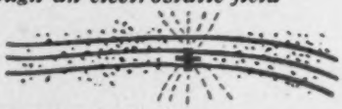


passes through an electrostatic field



receives a positive (+) charge

and is drawn to a collection plate of opposite polarity (—)

where it remains until flushed down the drain.

Small particles of air-borne dirt can damage the largest rotating electrical machinery, causing shutdowns and expensive repairs. Temperature rises may result from excessive dirt on the windings; threat of fire is increased, electrical breakdowns are more probable.

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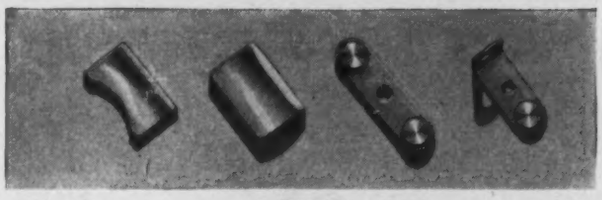

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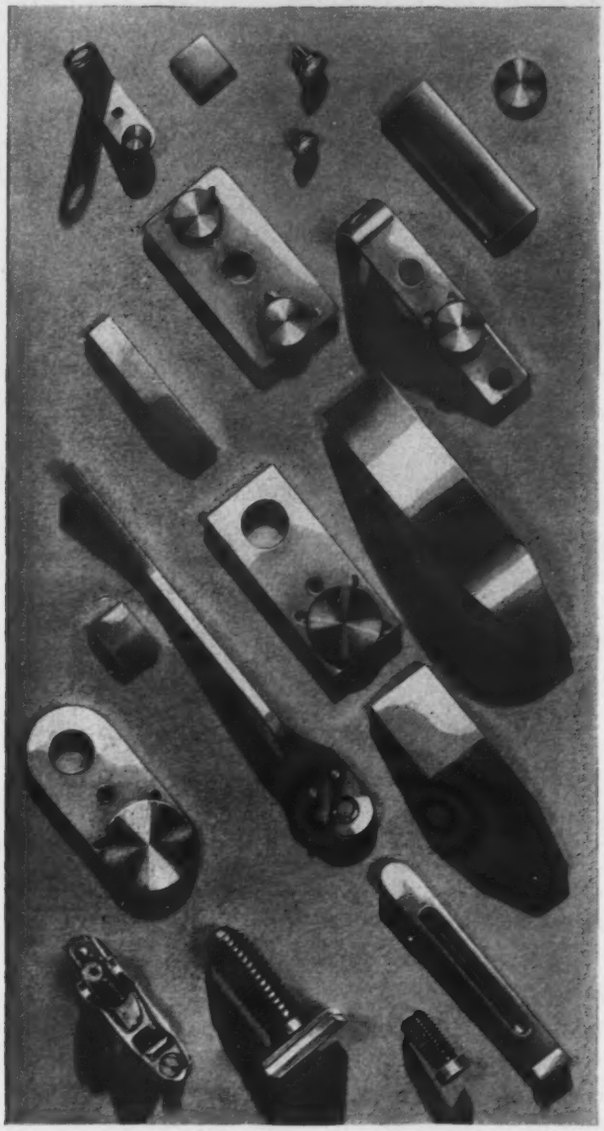

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If you manufacture machines, appliances or instruments whose operation depends wholly, or in part, on the efficiency of electrical contacts, perhaps we can point the way to better performance and longer life. There is much to be gained by an exchange of information before designs are complete, and by proper selection of contact materials. Write today for a free copy of the Mallory Contact Catalog.

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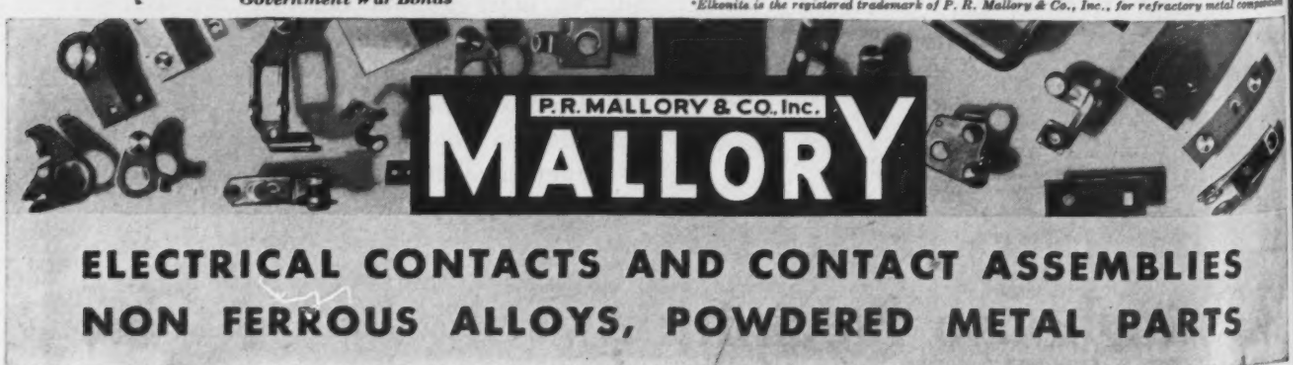

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provements in manufacturing technique and rnish formulation have earned continuing rec nition of Irvington Seamless Bias Varnished mbric Tape as a leader in its field. Laboratory and field performances repeatedly attest to its uniformity, workability, stable low power factor and resistance to deterioration. Through studied, careful preparation of the base cloth, smooth surfaces, unusual flexibility and tearing strength are assured, without sacrifice of electrical properties. And, although offering ample elongation, Irvington Seamless Bias Varnished Cambric Tape, after stretching, retains 70 percent, or more, of its original high dielectric strength, regardless of thickness, finish, or color.

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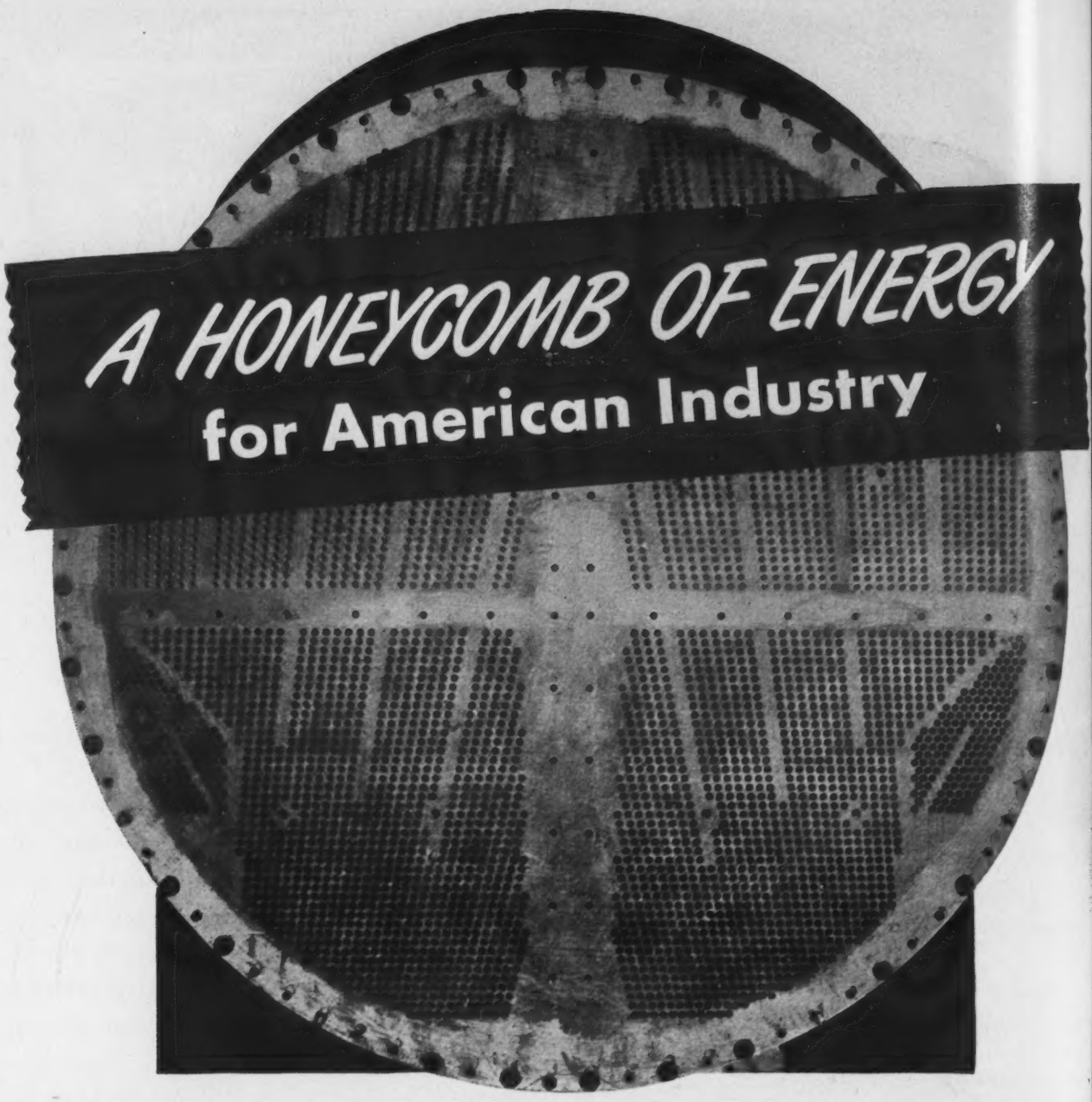

A HONEYCOMB OF ENERGY for American Industry

This one-piece tube sheet for a 13,300 sq. ft. surface condenser looks something like a honeycomb. It was fabricated for a public utility power station by C. H. Wheeler Manufacturing Company, Philadelphia, from an Anaconda Muntz Metal Circle 130″ in diameter and 1¼″ thick.

The holes, like the honeycomb cells, are not in exact geometric design. Size and location of tubes in the condenser are, however, carefully calculated for gradual and uniform condensation of steam, so that water returning to the boilers is at the highest possible temperature.

The accurate spacing of so many drilled and reamed holes in a tube sheet of this size requires a plate that is true to dimensions, commercially flat and readily machinable.

Anaconda plates for tube sheets are available in circles, half circles, segments, rectangles, squares, in widths up to 132″ (circles up to 138″), and weights up to 9,000 pounds. They are accurately alloyed and of uniform, close-grain structure. For detailed information on alloys and methods of manufacture, send for Publication B-2, "Anaconda Tubes and Plates for Condensers and Heat Exchangers."

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In 1/50 of a second it stops stock-still

WHEN a plane pilot presses the button to adjust control flaps, he wants just so much motion and no more.

But electric motors take time to stop. They overrun.

So while electric controls were desirable because they were less vulnerable and didn't freeze up, they had the disadvantage of overcontrolling.

What you see in the picture is the Lear solution. It is the Fastop Clutch.

With this clutch, controls stop instantly. For it stops stock-still in about 1/50 of a second.

There is nothing else like this Fastop Clutch. It is built right into the Lear electric motor as a unit.

As with all aircraft equipment, this unit had to meet unusual and rigid requirements of space and weight. It had to have rare power for its size. In fact the requirements were so severe, old-timers said it couldn't be done.

There will be many new conveniences and devices in the coming days of peace. Perhaps you are already planning one.

And perhaps you would welcome a motor like this and the Fastop Clutch — or some of the other 250 Lear products.

That is why we are telling you about them now. We want you to know that products like these are being made, and that there is available the kind of engineering that made them possible.

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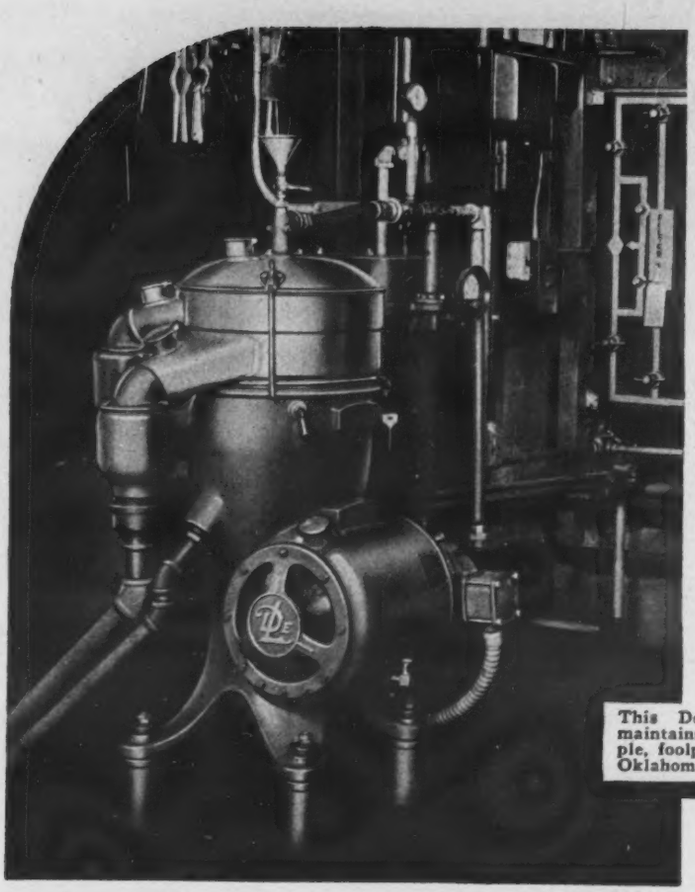

This De Laval Oil Purifier maintains insulating oil in simple, foolproof manner at a large Oklahoma Power Company.

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Higher OIL PURIFYING EFFICIENCY
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THE De Laval Insulating Oil Purifier used by a well-known Oklahoma Power Company restores the high dielectric value of the oil at a single pass, eliminating any necessity for re-runs. This makes possible a greater daily output of thoroughly dehydrated transformer or switch oil, and keeps maintenance costs at a minimum.

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De Laval Insulating Oil Purifiers are available in several sizes, as portable, semi-portable, or stationary units. Write for details.

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They are giants; for in their grip of steel is power for a thousand mills. Utility engineers around the world have long appreciated — in Blaw-Knox towers — the strength and durability and scientific design that make for efficient and economical operation.
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Numbers that mean

immediate circuits

THERE is no wiring problem when "Metal Molding" surface raceways are used. The wires are laid in the base; the capping snaps on. It's as simple as that to eliminate fishing and tearing up walls or floors to install additional circuits.

"Metal Molding" is manufactured in three sizes; 111 "Xtensionduct" carrying two No. 14 wires, 333 "Metal Molding" for four No. 12 or 14 wires and 888 "Metal Molding" used for carrying ten No. 14 wires for branch circuit feeds. "Florduct" for surface wiring on floors comes in two sizes. 711-A "Florduct" has capacity for three No. 12 or No. 14 wires and 733-A "Florduct" carries cable up to two 26 pair. All five raceways are [illegible] connectible with each other. These [illegible] appearing surface raceways have a [illegible] plete line of fittings having two or [illegible] different sizes of twistouts to take the vari[illegible] sizes of moldings.

All have a neutral gray finish which [illegible] easily be painted with either oil or wa[illegible] paints to match interiors. For that qu[illegible] surface wiring job, use "Florduct" [illegible] "Metal Molding."

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National Electric Products Corp.

Pittsburgh, Pa.

Electrical World

September 2, 1944

War-Time Earnings, Peace-Time Rates

A SAD EXHIBITION of distorted thinking is ow being given the nation. In one state after nother actions are being taken towards reduc- ons of electricity rates. The theory is that if ower companies are paying excess profits taxes en they must be charging excessive prices for eir services. If ever there was a "non sequi- r", here it is.

It is unfortunate for American business that nother name was not given to the excess profits x. A derogatory implication is usually con- yed by the word "excess", says the dictionary, resenting one definition of it as "more than is ght, proper or necessary". That definition and e implication from it have led men who should now better into strange ways of thought.

In time of war it is entirely right that earnings business undertakings should be limited by xation. Such limitation not only prevents the king of crass profit from death and suffering; also collects quickly and easily a part of the st of war. But it is entirely wrong to assume, ecause such taxation is tagged with the label, excess profits", that the earnings it limits in me of war are derived from prices that were or ill be excessive in time of peace.

Particularly is it wrong so to assume in the se of the electric utilities. Electricity rates are niversally set by legally constituted regulation. he war comes and more electricity is used, most f it by industries engaged in war production. he power companies' earnings increase and the xcess profits tax takes effect.

There are good reasons of heavier burdens hortening equipment life, of higher operating costs and of additional investment that should entitle the utilities to special consideration as regards incidence of the excess profits tax. But those matters will not be argued here; let us assume that the tax is justly and fairly applied to the utilities. The war has brought greater earnings to them; let us say for the purpose of the present discussion that those earnings should be taxed to help pay for the war.

Remembering that the increased earnings have come almost entirely from one group of customers—and a small group at that, the industrial plants—then by what right or title may other customers, who have contributed little or nothing to it, demand that the increase be applied to reduction of their rates?

When peace comes and war production precipitately declines, as it will, then utility earnings will decline with it. Utilities whose rates were reduced to the point where the excess profits tax no longer affected them will then find themselves with rates of return so low as possibly to prevent their survival as solvent enterprises. Certainly the returns they will then be able to earn will not make them the at least modestly attractive investments they must be if they are to do all that is expected of them in the postwar world.

Utility regulation has a two-fold duty of protection; to the public against overcharge and to the utilities against limitation of earnings that would impair their ability to serve the public. That duty is not well performed if the passing conditions of war time are twisted into arguments whose allowance as valid will hamstring the utilities when peace comes.

Generator Maintenance and Repair Methods

Improved methods for laying laminations, insulating, wedging and coil replacement are described—Progressive wedging holds laminations tightly—Inspection and maintenance practices for alternators and condensers briefly outlined

CARL W. SMITH*, Pacific Gas and Electric Co., San Francisco, Calif.

IN FORMER DAYS, lamination iron was piled in generators by turning a section of the stator on its side and blocking it up above the floor on large timbers. While in the process of piling the laminations, clamping was done by blocks on top of the laminations and under the clamping bolts. This, however, was not a very satisfactory method as the space gained was not held, for when the blocks were removed, the iron would spring up and space would be lost. Individual pieces were allowed to shift in the dovetail slots as well.

A method which has been used very successfully by the Pacific Gas and Electric Co. is by turning the section of the stator on its back and piling the lamination on steel slot drifts. Two drifts for each segment of lamination together with steel wedge drifts are used to keep the lamination in line (Fig. 1). The drifts are driven through the slots, extending sufficiently so that one air duct section may be piled at a time.

For Holding Laminations

An improved method for holding the iron which has been piled and drifted is the use of long bolts welded to flat steel plates ¾-in. thick and of sufficient width to cover one tooth each side of the slot. The bolt lies in the bottom of the slot (Fig. 2). After an air duct section has been piled, these clamps are loosened and moved up one at a time to clamp the section. This prevents losing the space while the next air duct section is being piled.

When the iron has been piled and the main clamps are tightened, the steel drifts are then driven through the slots, filling them in groups of some ten to twenty adjacent slots. Progressing around the stator one slot at a time for instance, the No. 1 drift is driven out and moved to No. 21 slot and the No. 2 drift is then driven through and moved up to slot No. 22, etc. until every slot has been drifted. The old method first mentioned required the filing of the slots and wedge dovetails in order to remove sharp edges and bring the slots to size. When the slots were filed to true them the filings were deposited in the crevices in the core, and after the machine was put in service, magnetism caused the small filings to whirl around and bore small holes in the mica insulation of the coils, thus causing failures. By using the drift method, it is not necessary to file a slots.

Hair-pin type swages are made steel to straddle the spacer in the duct so that the iron is not bent o while driving the wedge drifts. E slot is drifted in the wedge dove at the time the slot drift is dri (Fig. 2).

Care must be used in putting co in the slots. Very successful jobs h been done by the use of hand scr jacks mounted on a strong-back a supported from the shaft of the g erator or a pipe in the center of t stator, (Fig. 3). The coils are lin up to the slots and are pressed in pl by the strong-back. Use of mallets fiber tools is not permitted because the danger of crushing the mica a damaging the coils between turns.

FIG. 1—Steel wedge drifts are used in stacking generator laminations

*Electric Operation and Maintenance Dept.,

rder to insure a tight coil in the lot, it has been this company's prac- ce to fill the slot with class "B" in- ulation on the coil, and not to use any lass "A" slot armor, even as a guide. f the coils are made to allow space or slot armor, a sufficient number of yers of asbestos scuffing tape is dded to bring the coil to the slot imension with about .005-in. clear- nce. The scuffing tape is given a turation painting of an asphaltum ase varnish. Coils are heated to ap- roximately 90 deg. C. and pressed size in steel clamps and then ressed in place while hot.

Wedging of Coils

After the coils are in place, before edging, a strong-back one half of the ngth of the slot is used to hold the oil tightly in the slot while wedges e driven in the opposite end. Then e one-half strong-back is removed. he wedges which have been driven the opposite end hold the coil down hile the finished wedging is being one.

When driving new wedges into the ovetail slot, care must be used to see at the wedge slips through the dove- il loosely enough so that it may be iven along with the butt end of the ammer handle. When the wedge has en driven up to within its length of s location in the slot, an extra piece f insulation is placed under the edge and the wedge then driven ome. This never removes any of the edge until it is driven to its final lo- tion. Wedges should not be longer an the width of two air duct sections f the core, preferably the length of e section. If wood wedges are used, ey are made of preshrunk treated aple or its equivalent, and cut cross- ain to prevent splitting along the ge at the dovetail. Any shrinkage of e wedge takes place in the length d not in the width, which has no osening effect.

Generators which have been rebuilt ith new coils should be checked for ght wedges after 2 years of service. he new coils are pressed into the ots as tightly as possible, but after e machine has been heated and oled several times, the normal vibra- n of the core causes the coils to be- me set and formed anew, thus be- ming loose. The wedges shrink a rtain amount together with the driv- g strip, and this causes loose wedges. In order to prevent chafing and wearing of the coil insulation by vibration of the core, rewedging is necessary.

Wedges may be tested by the use of a $\frac{1}{2}$-lb. ball peen hammer, tapping the wedges lightly all along the slot. If the wedge is tight, the hammer will bounce, but if it is loose, it will be heard to slap against the dovetail. It will also sound hollow and the hammer will not bounce.

Replacing Old Coils

With types of class "B" insulation, every precaution must be used when removing coils from the slots to make repairs. The coils have become dry and more or less brittle after several years of service. In order to lift a throw, it is necessary to begin back about three throws, gradually raising each coil about one-eighth of an inch at a time, until the last coils in the throw to be lifted are above the first to be removed.

It is rather a problem to start the first coil. Therefore, steel wedges are made which are about 3 in. long and from $\frac{1}{32}$-in. to $\frac{1}{4}$-in. thick. The No. 1 wedge is driven through under the top coil. Then the second wedge, which is $\frac{1}{16}$-in. to $\frac{3}{8}$-in. thick, is driven behind No. 1, and so on, until each coil is raised. These wedges are called mice. The large or thick end of each mouse is notched so that the driving piece of drift will not slip above the mouse and damage the coil. The driving drift must not be more than $\frac{1}{16}$-in. thick. Details of the mouse are shown in Fig. 4. The coils are raised about $\frac{1}{4}$-in. each time a mouse is driven.

Another very satisfactory method used to remove the coils after the first $\frac{1}{4}$-in. mouse has been driven is the use of hair pins of sufficient width and length to slip over the upper coil and down into the air duct. Several of these hair pins are used along the slot. The hair pins are made of $\frac{1}{8} \times \frac{5}{16}$-in. spring steel of sufficient length when bent to slip over the strong-back mentioned and down to the bottom of the slot, with an inch or so to spare. The opened end of the hair pin is made to form short hooks. Hooks are of the required length to allow the pin to pass between the coil and air duct separator (Fig. 4). After the pins are in place, steel keys are pressed behind the air duct separator and the pin, to hold the hair pins tightly against the

FIG. 3—Hand jacks mounted on strong-back are used to press coils into slots

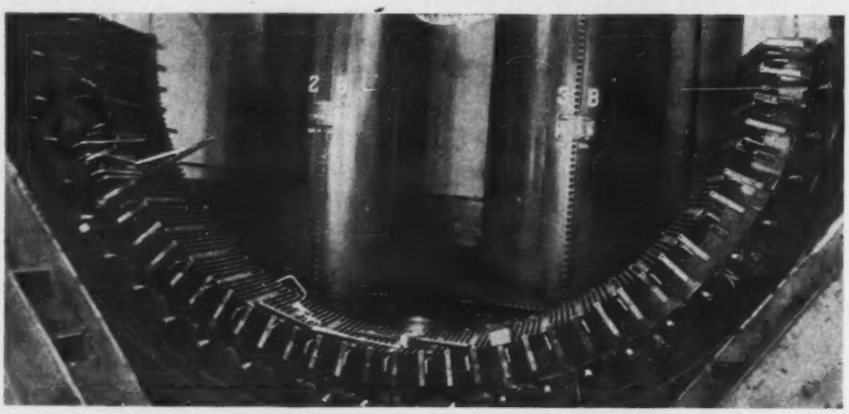


FIG. 2—Long bolts welded to steel plates hold laminations in place

coil as shown in the detail of Fig. 4.

The strong-back is then used as a pulling bar by operating the hand jack screws in the opposite direction. It has been found best to make up a number of the hair pins and keys so that when lifting a throw the pins may be put in their locations over a group of coils. In this way it is only necessary to slide the strong-back out from the pins on one coil, into the pins of a second, etc. to raise each coil slightly until all have been raised to allow the damaged coil to be removed.

Field Poles Removed

In many cases it is found that by removing three or four field poles on each side of the rotor (the field coils being removed on opposite sides of the rotor to balance it), there will be sufficient space to accommodate the strongback. The rotor is moved around as the work of removing coils progresses. This method makes it unnecessary to lift a throw of coils in more than one place. When it is necessary to strip completely the winding from the stator to be rewound with new coils, the throw is lifted at the break in the core on one side only. When all the coils have been removed from the top half, that half is lifted off and set up on the floor away from the pit. This allows any cleaning or straightening of the core slots to be done by part of a crew while the balance of the coils are being removed from the lower half in the pit.

New coils can then be installed in the upper half on the floor while the rest of the crew are cleaning or straightening the core on the lower half. It is not necessary to lift the rotor or disturb its bearings for a complete rewind. It is much more convenient to work on the upper half on the floor away from the pit. The upper half is placed in its original position on large timbers with a pipe secured at a center point on which are fastened the jack screws and strong-back. The strong-back can then be swung on an arc of the circle to press the coils in any desired slot.

When the top half has been completed, including wedging, connecting, tying to the ring, painting, etc., it can be placed back in its original position over the rotor. The work of installing the rest of the winding around the lower half is continued. Thus there is only one throw at the break on one side of the rotor to be considered.

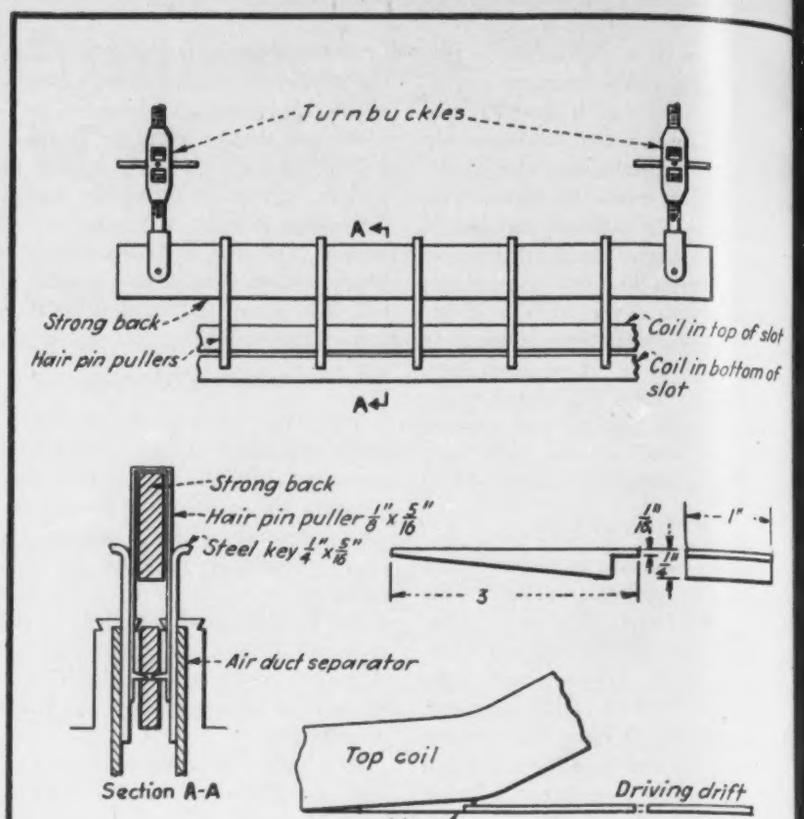


FIG. 4—At lower right are details of steel wedges or "mice" used for lifting stator coils in removing old windings. Above and at left below is depicted the method of using "hair-pin" pullers for removing coils after the first mouse has been driven

It has been the experience of this company that machines, especially condensers and turbo generators, should be opened every two years for general cleaning and inspection. The inspection consists of checking wedges, field connections, field coil tightness, tight keys, collector rings, brushes and dirt. Amortisseur windings are inspected for broken bars and loose ring bolts, etc.

Maintenance Tools

The special tools needed for this maintenance work are two dozen or more percolator brushes, ½-in. bristles, with twisted wire handles from 12-in. to 18-in. long. Also, about two spoke brushes and two or three hand scrub brushes. There should also be on hand driving strips of various thickness such as .010-in. and .015-in. in case it is necessary to tighten wedges. Cleaning solvent is recommended for such work and paint for a finish coat is needed.

Bearings are given an inspection for oil sludge and acidity. Oil rings may have loose splicing screws, shaft may be scored and perhaps the pedestal insulation has broken down, causing shaft currents. The air duct leading from the air washer to the machine is swept out clean, and the air ducts in the core of the generator are cleaned by the percolator brushes. The dust from this cleaning process can be taken care of by a portable vacuum cleaner and not blown out over the surrounding space by air pressure. Cleaning solvent must be of the highest flashing point, used cautiously with fire fighting equipment handy.

All maintenance and repair work is usually supervised at a central point such as the operating and maintenance department in the head office of the company. All jobs are handled according to a definite procedure which insures that each crew at the various stations receive the same type of instructions and are kept acquainted with the proper tools to use and the best methods of procedure. Records for future reference are kept in the department supervising the jobs.

Shave, Spray Standing Poles To Combat Shell Rot

Out-of-ground portion of western red cedar transmission poles are shaved and pressure sprayed in place with pentachlorphenol by Wisconsin utility to combat shell rot

H. KINGSTON, Transmission Superintendent Wisconsin Public Service Corp., Green Bay, Wis.

CISED butt-treated western red dar poles installed almost exclu-vely in Wisconsin Public Service rporation transmission lines be-ween 1924 and 1942 are now show-g serious deterioration, not at or elow ground line but under the ex-osed pole surface. This deteriora-on is the work of fungus, commonly nown as shell rot.

To combat the further encroach-ent of such shell rot in out-of-round portions of standing poles on e transmission system of this com-any, resort has been had to a special shaving and pressure spraying technique using a toxic solution of pentachlorphenol.

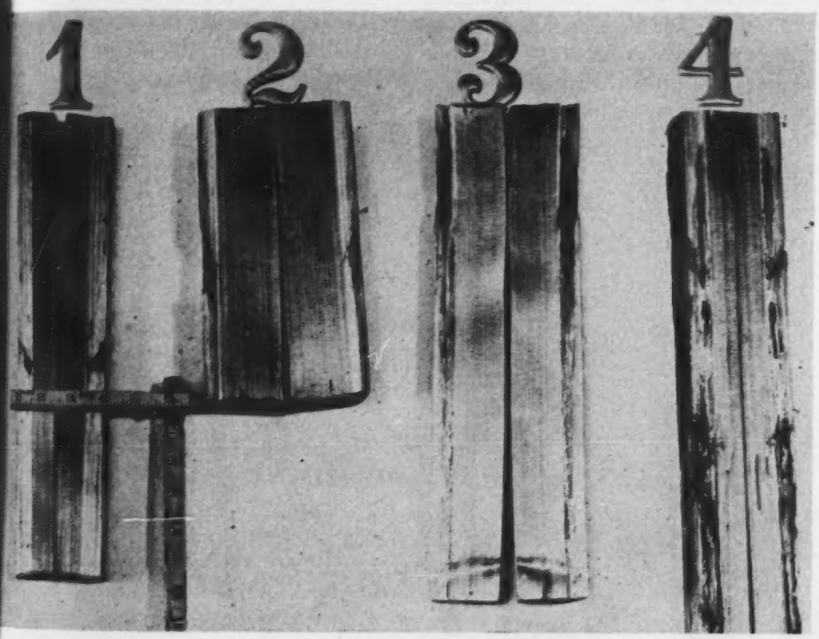
Special implements, not available on the market, were developed for the purpose. They consist of a special hand draw shave and an enclosed spray head capable of spraying the entire circumference as it is lowered on the pole. Using these tools, in the manner to be described, it has been found possible to treat an entire transmission pole at an estimated cost of $6.25, an amount that will be shown to be justified if slightly more than one year is added to the pole life.

Examination of hundreds of poles indicates that at least 95 percent of the shell rot is caused by spur marks left by linemen. The process seems to be as follows: During rains, water enters the spur marks and saturates them. Fungus spores, always present in the air and on outdoor surfaces, are carried into the wound and the warmth of the summer creates an ideal fungus growing condition. The decayed wood becomes a moisture absorbing sponge that allows the fungus to work up as well as down from a spur mark with equal rapidity. But, due to the cell construction of the wood decay laterally is slower.

Treated butts of these western cedar poles are perfectly sound. It seems certain that if the shell rot condition is successfully treated, life of the oldest poles can be extended another 20 years.

A method of combatting shell rot on standing poles that early comes to mind is to spray them liberally with a long-lasting, fungus-killing solution. Pentachlorphenol, which has recently become available in quantity and at a price suitable for timber treatment, appears to be such a material. Dissolved in light fuel oil, pentachlorphenol forms a highly toxic, quick-penetrating solution that remains in the wood for many years.

After an untreated pole has been in service more than eight or nine years, however, shell rot works under the outside surface and spray treatment alone, no matter how thorough, does not reach it to kill the fungus. Enough shell rot must first be shaved off to allow the spray to penetrate thoroughly down to sound wood.



SPLIT through the spur marks, these WRC pole samples show how shell rot starts there. No. 1 shows a spur mark in a pole installed for seven years. Dark spongy wound area shows decay is starting. No. 2 shows where spur broke out opening wound to air and light. No shell rot has started. The pole has been in 20 years. No. 3 is a 20-year-old-pole, shell rot has worked under the surface. No. 4 reveals how decay from a series of spur marks has joined up. The entire surface of this 20-year-old-pole is ready to fall to the ground

Satisfactory implements for pole shaving and spraying standing poles are not available on the market. However, after extensive experimentation and consultation with a neighboring utility working on the same problem, tools and equipment have been developed by this company which do the work very well, although still subject to alteration.

For shaving poles a hand-drawn shave is used which has a wave in the blade for gouging out spur marks and for working around knots. Knots are sawed off with a pruning saw.

The pressure pole spraying machine that is used is built around an orchard sprayer of the wheelbarrow type fitted with a 100-ft. reel of $\frac{3}{8}$ in. chemical-proof hose. This hose is connected to a sprayer head consisting of a sheet metal drum enclosing eight equally spaced nozzles which spray the entire circumference of the pole in one operation.

Each nozzle is mounted in the center and inside of a U-shaped frame that carries casters which ride along the pole surface keeping the nozzles a fixed distance from the pole. Each U-frame is held in place by a shaft that works in a pipe extending through the drum wall. A spring holds the casters in contact with the pole. The top and bottom of the drum are sealed from escaping spray by flat crescent-shaped brushes mounted on the legs of the U-frame so that they contact the pole surface. Spaces between the brushes and drum are closed off by oil proof fabric. A recess in the bottom of the drum accumulates spray and drippings. The drum, shown, is split and hinged so that it can be placed around the pole.

Need has been found for a small single nozzle head for spraying above primary or distribution circuits and at other places where the large spray head cannot be used. This nozzle is mounted inside a hollow brush curved to fit the pole. A can is provided to catch the drippings. The hose runs through a fibre conduit handle, and liquid, hose and handle are all tested non-conductors.

All of this equipment is carried on a small truck from which the pump can be operated without removal except in the most inaccessible locations.

Procedure

Pole shaving operations begin as near the top of the pole as safety permits and progress downward. Distribution circuits on transmission poles must be adequately covered so that the work can be done safely. Should there be any shell rot under the distribution arm or brace it should be chiseled out and the nut on the bolt tightened.

Pole shaving is not good fill-in work because it is very strenuous and unless the men can keep at it steadily enough to become hardened, progress will be slow. The best season for pole shaving is through the late autumn and winter.

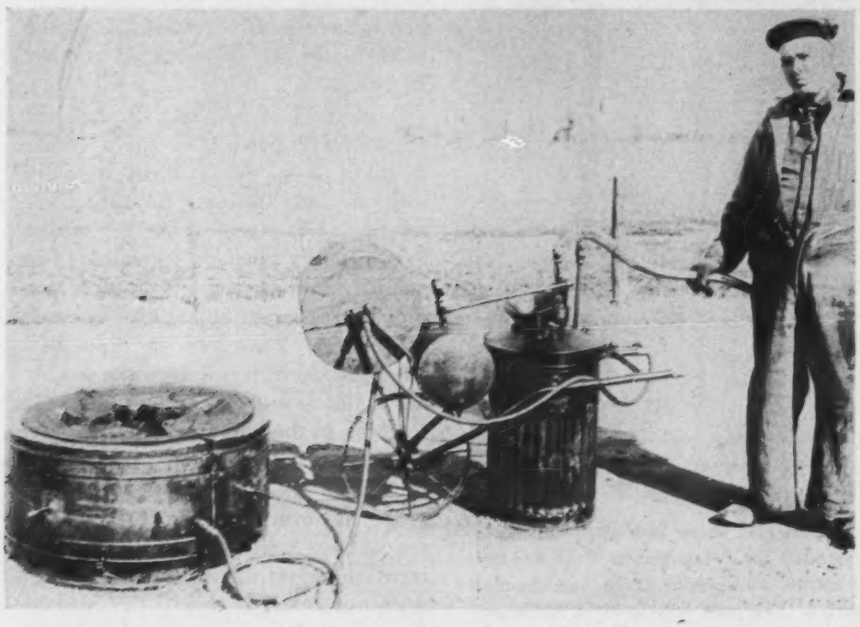
SPECIAL draw shave has a wave in the blade for gouging out spur marks and working around knots. The lineman's safety belt is protected with two short lengths of 2-in. fire hose slipped over the belt and held with wire. Linemen wears face shield to keep shavings and dust out of his eyes

Where the original butt treatment tapers upward into the untreated wood special care should be taken so that the treated wood is not damaged. Shaving should be done upward over this portion of the pole and it should leave a long taper. To seal off the exposed fibre ends and prevent moisture from getting behind the treated shell this area should be painted with a wood preserving plastic.

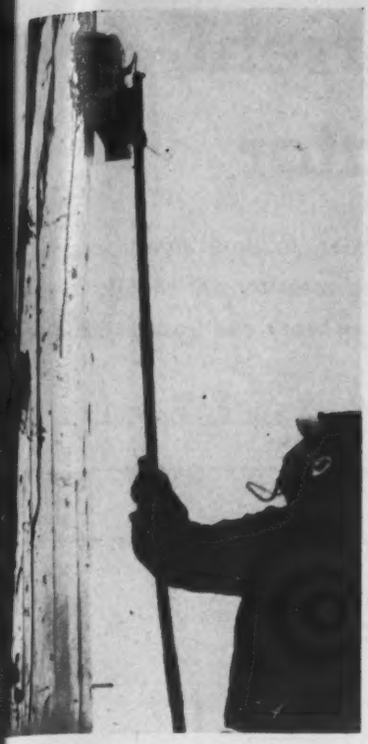
During spraying the large head is suspended from two single sheaves secured to a small spreader that is hoisted to the top of the pole with a hand line which is then securely tied off. The spray head is clamped around the pole and pulled as high as safety permits by two men handling the two sets of tackle.

In the meantime pressure in the drum has been pumped up to the proper value. The operator opens the valve as the sprayer head begins to descend. About 50 psi is required at the top of a 55-ft. pole, diminishing to 25 psi. at the bottom. Some pumping is required to maintain a properly diminishing pressure as the spray head descends. When spraying is complete the blocks and spreader are unhooked and the line pulled down off the crossarm.

Under most favorable conditions as many as 30 poles can be sprayed in a day by a three-man crew with the sprayer and a small truck. Speed largely depends on the type of terrain, the accessibility of the structures and the absence of low voltage circuits.



POLE SPRAY machine consists of divided, hinged spraying head and orchard sprayer with reel holding 100 ft. of $\frac{3}{8}$ in. chemical-proof hose. A quick detachable connection at reel hub is used as swivel joint to permit reeling. Another is at spraying head



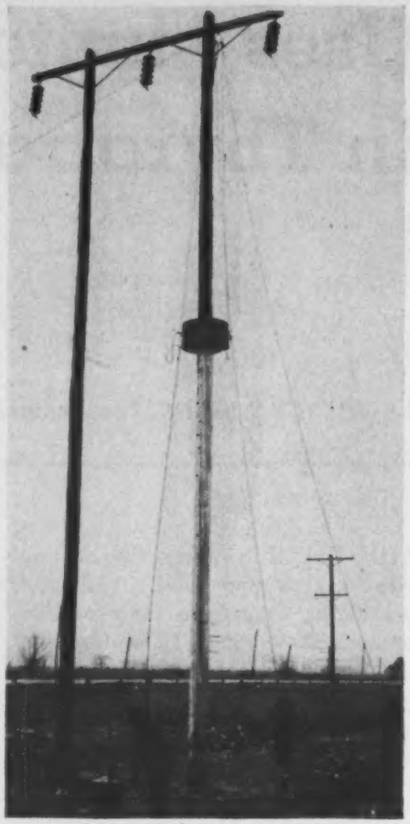
INGLE SPRAY head for treating above primary or distribution circuits and other places where the large spray head cannot be used. Nozzle is inside a hollow brush that fits the pole. Note can used to catch the drip. Hose runs through fibre conduit handle

Pole shaving runs about $3.65 per le on single pole lines located on ghways and carrying distribution rcuits. The poles in these lines are) ft. and 45 ft. in length. Most H-frame lines run cross-country, and carry no distribution. The poles in these lines are 55 ft. or better in length and the cost of shaving them is only slightly higher.

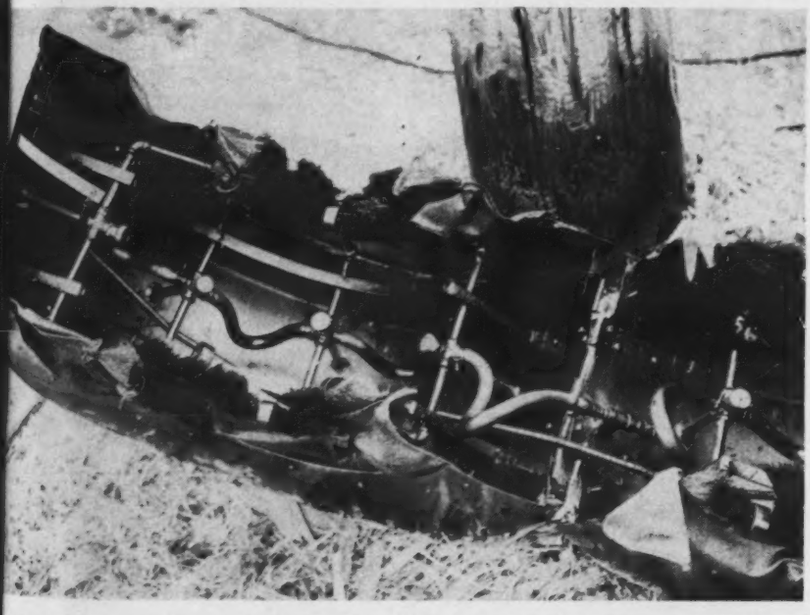
Spraying costs vary, of course, with the size of poles and their accessibility. Also, newly shaved poles take less spray solution than weathered poles. Recently some 55 ft. unshaven poles that were set in 1940 were sprayed and it was found that they took 8 gal. of solution per pole, while a pole of the same size with most of the sap wood shaved off on account of shell rot took only 3 gal. The average cost for spraying newly shaved poles is $2.60 including cost of spray material.

Omitting its value from the safety standpoint, it can be proven that the shaving and spraying operation pays for itself quickly in dollars and cents.

Take, for example, a butt-treated western red cedar pole that was installed at a cost of $60 at the time that the line was built twenty years ago. The average life of a pole of this type is commonly estimated at about 30 years. That means that every year added to the life of that pole is worth $2. Further, it will cost about $90 to replace this pole. Every year that it is possible to defer this replacement the annual charges on the $30 increased cost of the new pole will be saved. Figuring annual costs at 10 percent, we have an annual saving of $3 per year which, added to the $2 makes a total of $5 per year which can be saved by shell rot treatment.



SPRAYING H-FRAME. A three-man crew can spray as many as 30 poles a day. About 50 psi. is required at top of 55-ft. pole. It decreases to 25 psi. at bottom of the pole



INTERIOR of spray head, shows drum is split and hinged to go around pole. Eight nozzles are mounted at the center and inside. U-shaped frames carry castors that run along pole keeping nozzles at fixed distance from poles. Crescent-shaped brushes at top and bottom confine spray. Recess in bottom of drum catches spray and drippings

As previously pointed out, the cost of shaving and spraying a pole is about $6.25. If the life of the pole is only increased by one year this cost is nearly justified.

Pole shaving and spraying is not offered as a substitute for modern full length treatment of new poles. Since they have been available the Wisconsin Public Service Corporation has been using full length treated poles exclusively with the hope that they will eliminate all of the pole maintenance work herein described.

The best full length treatment offered on the market today, however, only guarantees one-half inch penetration. Most spur marks on western cedar poles are more than half an inch in depth. What will happen if these spur marks allow water to get behind that treated shell? To gain unquestioned permanence for western red cedar poles a guaranteed $\frac{3}{4}$-in. preservative penetration would be required.

Uses Limited Signal Current In Thyratron Fault Locator

Addition of constant-current transformer, to limit signal current, increases effectiveness of grid-controlled mercury arc rectifier type signal generator for fault location in a.c. network and transmission cables

LAWRENCE E. KLINE, Test Engineer-Cable Test Div., Electrical System, The Detroit Edison Co.

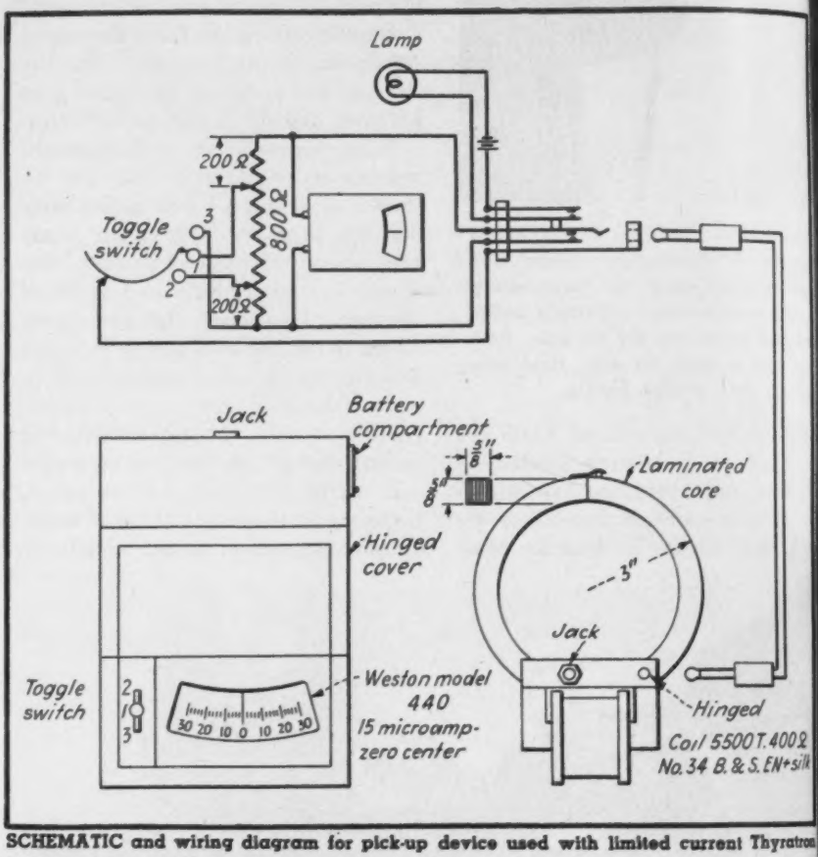
WIDE USE of the alternating-current network area method of distribution is bringing changes in fault location methods. New signal generators and detection equipment are being developed for networks to overcome inherent tendencies of the tracing signal to spread, in older location schemes, over numerous network taps and branches.

In some of the newer schemes a grid-controlled mercury arc rectifier tube has been used to generate a d.c. tracing signal. The idea is not strictly new. However, addition of a constant-current transformer to limit signal current, as in the fault locator here described, is a departure contributing to effectiveness.

Steady Fault Current

Many existing d.c. locators operate on the constant potential system using reactors to regulate fault current. When a constant potential source is applied to a cable fault of varying resistance, erratic fault currents are encountered. In the "limited-current Thyratron fault locator," however, a constant-current supply and therefore a steady fault current is maintained up to the capacity of the constant-current transformer used.

This condition of unvarying fault current is highly desirable. Experience shows that this type of locator performs well both on network cables and transmission cable faults of the most difficult type, that is: (a) when the fault is submerged in water with the fault resistance varying; (b) when the conductor is burned open with low resistance to ground, making capacity measurements almost worthless and (c) when cables are paralleled with



SCHEMATIC and wiring diagram for pick-up device used with limited current Thyratron fault location which maintains a steady fault current

ends connected to single line disconnecting switches, requiring separation before Murray Loop or capacity bridge measurements can be made.

A 15-kva., constant current street lighting transformer of the oil-immersed overhead type with its primary rewound for 220-volt operation is used in our portable locators to limit signal current. To save weight and space, the oil tank was discarded. A type FG-41 Thyratron tube was selected for use with the secondary current of 6.6 amp. Continuous current rating of this tube is 12.5 amp.; its inverse voltage seldom exceeds 3,500 volts. The rectifier is often used with larger transformers at transmission stations. For interchangeability, all rectifier units are identical. Any one of them can be used with the larger constant-current transformers.

The rectifier circuit is diagrammed herewith. It is a standard rectifier circuit using a type 80 tube to supply the grid bias potential. Since strictly "on" and "off" operation of the FG-41 tube was desired, no effort was made to in-

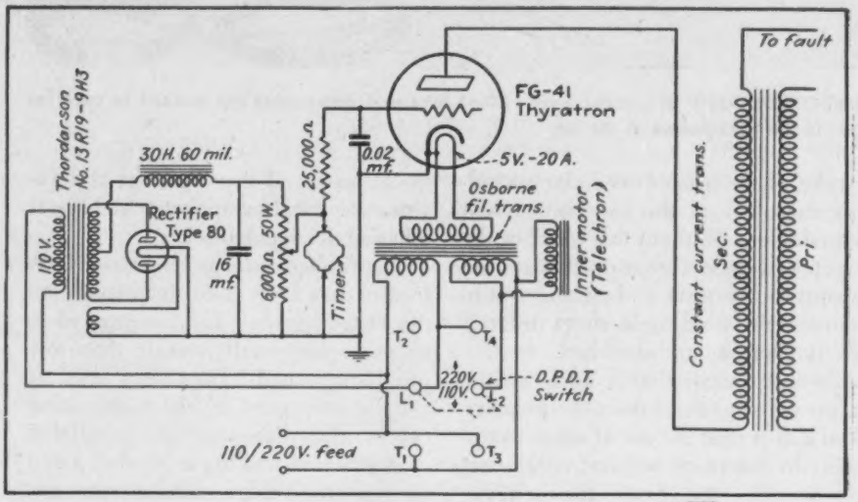
rporate any phase shift control ethod. The signal timing disk has ur lobes, each of 30 deg. arc and riven by a 1 rpm. Telechron motor generate four cycles per minute, nsisting of time periods of 5 seconds n" and 10 seconds "off." The eeder resistor has sufficient resistnce to prevent overloading the bias ansformer when the timing disk reces the grid voltage to the cathode otential, causing the Thyratron tube fire. The filament transformer of e FG-41 tube has double primary indings for either series or parallel peration so that either 110 volts or 20 volts may be used for supply.

Can Handle Largest Cable

The pick-up device consists of a cirular iron core, big enough to encircle e largest cable encountered, with a ,500-turn, 400-ohm winding. The on circuit is split and hinged to ake placement around the cable posible. A spring catch keeps the butt ap uniform and small. A single-cirit telephone jack is used with a tandard telephone plug on each end f the connecting cord between the oil and the meter box.

A Model 440 Weston zero-center alvanometer of 15 micro-ampere fullcale sensitivity is used as the indicar. Response of the galvanometer can e reduced by the use of a shunt with ree ranges of sensitivity. Meter range selection may be accomplished by the use of a three-point, spring return toggle switch. The neutral or center point of the switch may be used for the low sensitivity meter range.

Some form of illumination is desirable when using the pick-up set at night or in poorly lighted areas. To provide this the meter box contains a small 3-volt dial lamp and flashlight batteries. The dial lamp is turned on and off by a three-circuit jack, as shown in the circuit diagram. One circuit of this jack is also used as a short circuiting connection, when the plug is removed, to prevent injury to the meter element. By including the lamp and batteries in the meter assembly, one hand is freed that otherwise would be holding a flashlight.



WIRING DIAGRAM of complete rectifier assembly shows connections of constant-current transformer for limiting signal current used in fault location

NSTALLATION of fault locator equipment truck. Note the double-acting shock bsorber on the 15-kva. constant current ransformer. Knife switch above transormer disconnects primary feed and perits use of other equipment in truck without energizing transformer

Principle of Operation

When the timing disk either starts or stops the flow of signal current in the cable, a polarized deflection occurs on the galvanometer indicator. This deflection is used to determine the direction of the cable fault from the point where the reading is being made.

If the coil is always applied around the cable in the same direction, for example, with the jack toward the signal generator, all current "on" indications will be of like polarity and all current "off" readings will be of opposite polarity. These deflections are quite uniform at all points along the cable between the signal generator and the cable fault, even though there are numerous branches and taps along the route. The tap cables show no indication of current flow since they are not in the fault current circuit.

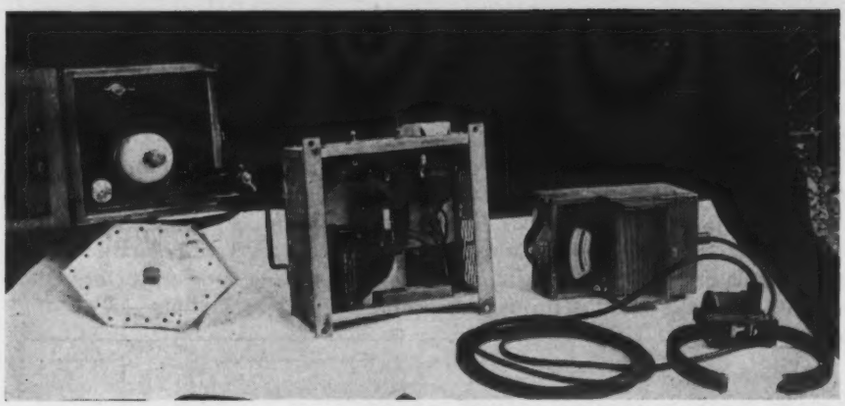
As the faulted section of the cable is approached, current flow can be detected with the pick-up coil, in the cable bonding wires, within a manhole or two of the fault. This always indicates proximity to the point of failure. Beyond the cable fault there is either no current flow, a greatly reduced indication or a reversed polarity indication, depending upon whether the cable is single or multiple.

Usually when paralleled cables are involved, and when locating the cable fault without disconnecting either station end, there is enough current flowing around the long circuit to the fault to give a reversed polarity deflection, beyond the point of failure, from the signal generator. Quite often at the faulted section of cable, some visual or audible indication is present such as smoke or arc roar. This generally is the case if the cable duct is not obstructed.

Actual installations

The constant-current characteristic of this fault locator is very effective in burning down a high resistance cable fault, or if it cannot reduce the fault it will generate a husky arc that is very evident. The characteristic of the constant-current transformer of maintaining rated current output up to its maximum capacity, is what makes this method of fault location so effective and such an improvement over any constant potential method.

An accompanying illustration shows one of the portable installations of the fault locating equipment in a truck. Note particularly the use of a double acting shock absorber to cushion the



UNDERSIDE VIEW of rectifier base. FG-41 tube and accessories are packed in carrying box in the background at the left

stroke of the hinged secondary winding assembly of the constant-current transformer. Without this snubber the secondary action, even during normal operation, is quite violent and would damage the winding in short order if the impact was not absorbed.

In this installation a knife switch is provided to disconnect the primary feed and permit the use of other equipment in the truck without energizing the transformer. Since the primary current, at 220 volts input is rather high, all control switching is done through a manually operated circuit breaker.

It will be seen in the photographs that a stud is provided on the front of the rectifier base. This is for ground connection. Great care must be used in grounding the base assembly of the rectifier at all times. Otherwise high voltages will develop between the metal base and the windings and various electrical components at 110- or 220-volt feed potential.

The limited current Thyratron fault locator has been used extensively on the Detroit system and has proved to be more universally usable than any previous methods. The time and effort usually consumed in short circuiting cables and disconnecting paralleled cables before making a Murray Loop or capacity bridge measurement are eliminated. This results in a notable reduction in man-hours of labor and cable outage time for each cable failure. In practice it is possible to locate and isolate a faulted section of cable without the presence of any visual or audible indications; reliance is placed solely upon the deflections of the pick-up device. Any procedure that eliminates steps in fault location is welcome to cable trouble-shooting practice.

THYRATRON rectifier assembled and ready for use. Pick up coil and galvanometer are at left and right respectively. Provision for either 110- or 220-volt operation of the rectifier unit is provided by the toggle switch on the front of the rectifier assembly

The Post-War Farm Market

Writing of the potentialities of farm electrification in a brochure recently published by the Farm Journal, Frank E. Watts says that if plans of power companies and of REA are realized "2,000,000 additional farms will have electric service within five years following the war. This will be an entirely new market, and has sales prospects of at least two billion dollars. Perhaps the greatest reason for looking at the farm market so optimistically is that farmers for the first time in the history of agriculture now have the money to take full advantage of all the developments made possible through scientific research and applications of power to their work.

Money in the Bank

"A concrete illustration of how much spendable money farmers have occurred recently on a farm near Spencer, Iowa, where 800 farmers gathered to bid on a relatively new rubber-tired tractor offered at auction, and each wrote out a check for approximately $900—the ceiling price—dropped it in a hat and waited feverishly for the winning check to be drawn by lot; nearly $750,000 laid on the line for one tractor! One is impressed by two implications: first, that 800 farmers in one community have enough money lying idle in the banks so that each one can write his check for $900 and not overdraw the account; and second, that 800 farmers in one Iowa community are avid prospects for tractors. They are equally as good prospects for electrical equipment and appliances.

"Economic conditions in war devastated countries will assure a continuance of high income for a number of years. Further, a great revolution which is of more permanent importance in agriculture is now under way—a revolution which will have far reaching social and economic aspects. Soil conservation, greater yields per acre, new crops, many grown for industrial use, utilization of more of the crop, applications of mechanical and electric power to farm jobs all add up to a new era in agriculture—an era which will see the industry fully established on the most solid foundation in its history."

Easy Meter Testing

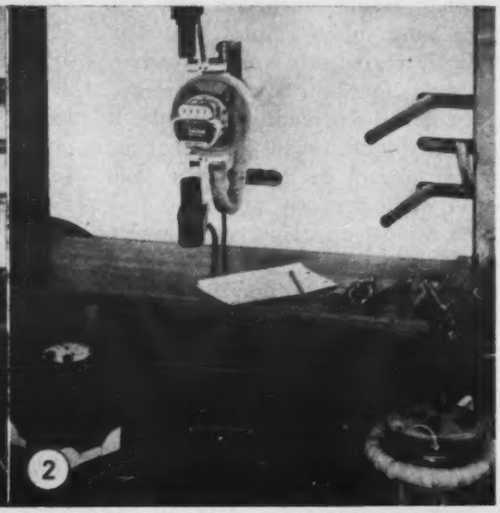
Study to minimize motions and to bring all operations into most convenient arrangement results in board literally built around tester

WALLACE HARRISON, Knoxville (Tenn.) E. P. & W. Board

IN ORDER to make meter testing easier by reducing and simplifying the motions of the tester, thus to minimize fatigue and to increase output, intensive study was given to facility of operations when a new test board was contemplated for the meter department of the Knoxville Electric Power & Water Board.

The result of that study appears in the following features of the board and in the accompanying pictures.

1



2

The rotating standard is on a hinged arm and can be moved to the most convenient position, as well as turned to the best angle for easy reading. (Fig. 2)

The thin single-board work top allows plenty of leg room. (Figs 1, 2)

The tape-wound basket can be swung into convenient position for sealing the tested meter. (Fig. 1)

Two vertical adjustments of six inches each allow the meter to be set at the height to suit the individual tester. (Fig. 3)

By releasing a clamp behind the board the meter can be moved toward or away from the tester to reach the preferred easy working place.

The meter socket is mounted on a vertical shaft on which the meter may be turned right or left when inspecting gear mesh, top bearing, magnet pole clearances, etc. (Fig. 1)

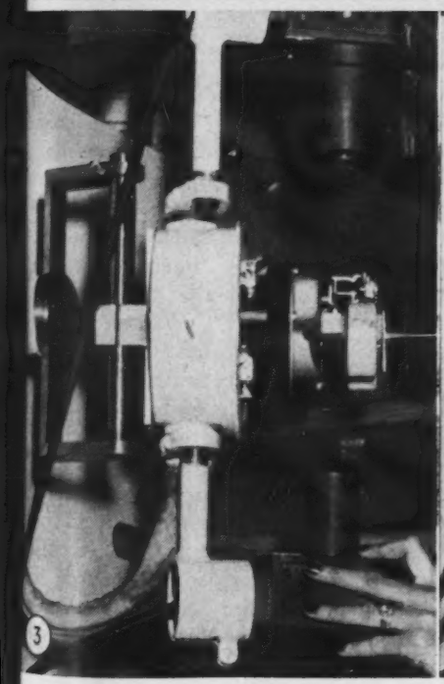
The photo-cell and light source are mounted on movable supports for easy adjustment to different types of meters. (Figs. 3, 4)

The photo-cell can be swung out of position to allow jewel replacement in the meter.

An adapter equipped with a "quick connector" can be plugged into the standard stocket for testing "A"-type meters. (Figs. 4, 5)

Dead-front, long-handle load switches assure safety of the tester and are easy to operate. (Fig. 2)

The board can be used for testing all sizes and types of two- and three-wire single-phase meters.



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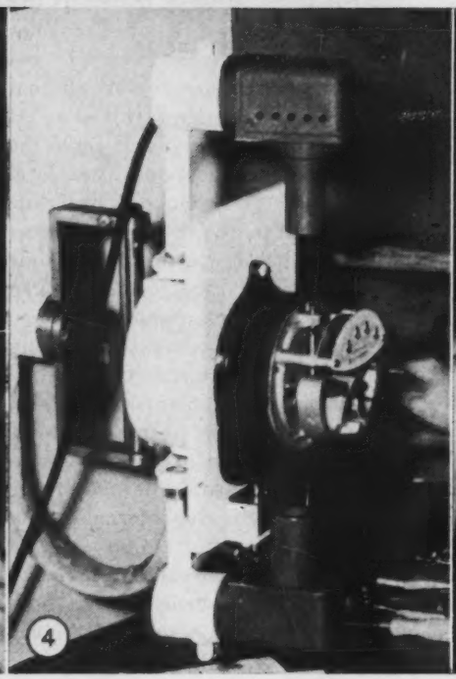

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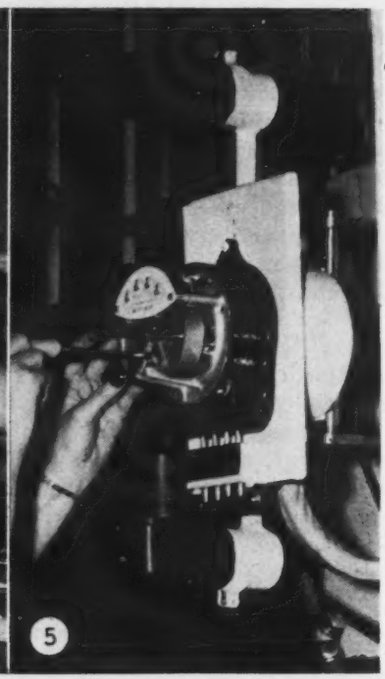


5

Insulating Varnishes: Properties and Applications

Technical characteristics of wartime electrical varnishes and precautions to observe in selecting and applying them to derive effective protection and performance of windings

GEORGE J. HEPP Sales Engineer, Irvington Varnish and Insulator Co., Irvington, N. J.

IN PREWAR DAYS insulating varnishes were axiomatically the least familiar material used in the electrical industry. Now, however, with emphasis on performance and long life, many production, control, and engineering staffs are giving more definite consideration to the materials with which electrical windings are impregnated or coated. This consideration naturally causes many questions to be raised. Why use insulating varnish? If insulating varnish must be used, which type best suits the particular application? Is the quality of insulating varnish a war casualty due to material shortages? All these and many other questions are being asked each day.

Insulating varnishes are generally used for one or more of four principal objectives. They protect the windings from the deleterious action of oils, acids, alkalies, and moisture. They produce bonding between individual conductors which helps to eliminate chafing of adjacent turns of windings. They provide increased dielectric, insulation, and thermal conductivity, and last but not least, improve the appearance of coils and assembled windings.

Alternative Constituents

Although material shortages have been troublesome, the manufacturers of insulating varnishes have not only been equal to the task assigned them, but have actually been successful in developing varnishes which perform and endure under conditions believed impossible a few years ago.

During the past few years it has been necessary to reformulate the conventional type varnishes as there have been long periods when Chinawood oil, some resins and driers, and other ingredients were unobtainable. The internal drying varnishes, on the other hand, often employ naturally available ingredients, such as cashew nut shell liquid or synthetic resins, which have been readily available. It has been found, for instance, that the natural phenol in cashew nut shell liquid when properly processed produces a most desirable resin, highly suitable and very successfully used in the manufacture of internal drying varnishes.

Types of Varnishes

In any discussion of insulating varnishes it is absolutely necessary to clarify and group various varnishes so that a clearer picture and a greater understanding of these materials are obtained. The types of varnishes available are many and varied. Because of the great number of different applications, no single varnish has yet been formulated which will serve the purpose of all applications. Therefore, by checking the attached chart one will find that there are air drying varnishes and baking varnishes. The air drying varnishes are further broken up into two groups; namely, air drying insulating varnish, and air drying finishing varnish, or sometimes called spirit varnish. Both are available in clear and black. The baking varnishes are divided into two main groups—the conventional non-internal drying varnish and the newer internal drying type—into the latter group fall the synthetic resin, phenolaldehyde, and modified phenol varnishes. In both classes are to be found clear and black varnishes.

The distinction made between internal curing and non-internal curing varnish is clear cut. The first type dries or cures in a mass in the interior of the windings, while the latter type, depending principally on oxidation, dries on the surface of the windings leaving wet or tacky interiors. Inasmuch as the non-internal curing varnishes were used long before the internal drying type was available, let use first discuss these which do not dry internally, and refer to them as the conventional type of insulating varnish.

The conventional insulating varnishes are generally composed of vegetable oils and, in the case of varnish, clear gums, resins, and solvents. In the conventional black varnish the clear gums and resins are partly or wholly replaced by asphalt and solvents are incorporated. The clear conventional varnish will usually dry harder and excel in pentrating qualities, bonding, and oil resistance. The black conventional varnish, on the other hand, will generally produce a film having greater plasticity, heat endurance, acid, and moisture resistance plus higher dielectric strength. The black varnishes also produce a film of considerably greater life. These varnishes dry principally by oxidation accelerated by heat. As the exterior of the coils and windings are exposed to the air the drying of these varnishes takes place primarily on the surface of the coil, and during the drying process it is not unusual that a tough film is formed. The longer the varnish is baked, the tougher this film becomes, and often the formation of this film causes solvents to be trapped deep in the interior

of the windings thus prohibiting thorough drying of that portion of the varnish which has penetrated to the interior of the coils. It is therefore characteristic of the conventional varnishes that they will not dry on the interior of the windings, that they are internally corrosive, and that they do not have the dip tank stability and storage stability of the internal drying varnishes. These varnishes are subject to livering and skinning, not only in the dip tank, but also in the shipping container if they are stored for too long a time.

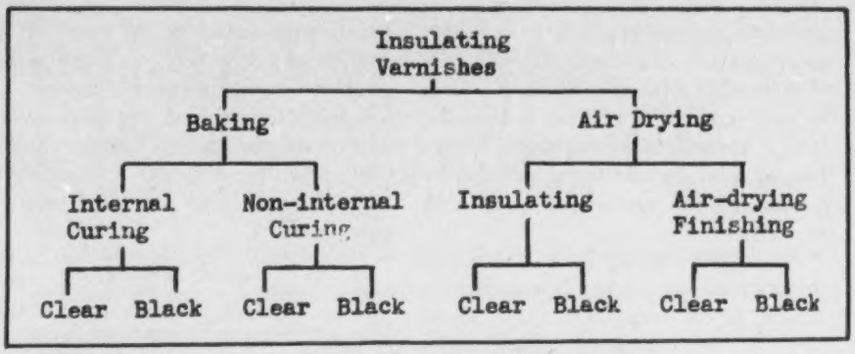
Less Critical Shortages

The internal drying varnishes are composed usually of natural or synthetic resins sometimes modified with oils and thinned with solvent. Many of these varnishes require high- solvency coal-tar thinners but there are a few which carry the more desirable milder petroleum derivations. The internal drying varnishes are at least the equal of the conventional varnishes in oil, water, acid, and alkali resistance, and excel the conventional varnishes in bonding, heat resistance, storage stability, and lack of corrosion. This type of varnish is rapidly replacing the conventional type is a majority of applications. Due to their increased mechanical strength, non-corrosive characteristics, and ability to perform under the most adverse conditions, these varnishes are often specified in preference to the conventional type. With this type of varnish, raw material shortages have generally been less critical than with the conventional type.

The internal drying varnishes, being independent of oxidation for drying, are converted from a liquid to a solid state by baking at temperatures of from 250 to 300 deg. F for periods ranging generally from 4 to 20 hours. The baking time, naturally, depends on the mass, size, and shape of the windings. By so drying or curing, greater bonding is obtained, uncured pockets of liquid varnish are avoided, and the decomposition is at a much slower rate. Methods of applying baking-impregnating varnishes will be discussed later in this article.

Air Drying Varnishes

If one will look again at the chart on insulating varnishes, it will be seen that air-drying varnishes are divided into two classes; namely, the air-drying insulating varnishes and the air-drying spirit finishing varnishes. In both cases you will see that these are available either as clear or black varnishes. Air-drying insulating varnish ranks above spirit varnishes in the diversification of use and demand.



CLASSIFICATION of insulating varnishes in characteristic groups

In no case will an air-drying insulating varnish produce the desirable characteristics and qualities that can be obtained from a baking varnish, and air-drying varnishes are seldom, if ever, recommended in preference to baking varnishes. However, circumstances alter cases, and it is sometimes necessary and occasionally desirable to use varnishes that will dry in air at room temperature. Two such cases might be for the insulation of an electric motor in a mine shaft where baking facilities are not available and where the motor must be insulated on the spot or in some industrial plants where there has been installed a system for the periodic cleaning and reinsulating of the electrical equipment. Also in those cases where an additional coat of varnish is desired over previously impregnated windings, air drying varnishes are used, and it is not unusual to give these varnishes a short bake at a moderate temperature to accelerate their drying.

Finishing Varnishes

Finishing or spirit varnishes are exactly what their name implies. They are compounded of shellac or a shellac alternate and alcohol and are applied in addition to impregnating or air drying insulating varnishes. The purpose of finishing varnishes is to add to the appearance of the windings and to provide additional protection. The dried film of the finishing varnish is glossy, brittle, and hard, in addition to being oil resistant. In no case should a finishing varnish be used as an impregnant. Because of the nature of the solvent contained in spirit or finishing varnishes, a definite hazard would be set up from the standpoint of attacking the enamel coating of the magnet wire.

Application of Insulating Varnishes

Now that we have given an idea of the types of varnishes that are available, the next phase of the insulating varnishes to consider is the methods of applying them. Starting with the simplest application and working our way up to more complicated procedures, let us first consider spirit varnishes. These varnishes are applied usually by dipping, brushing, or spraying, and allowed to air dry. Air drying insulating varnishes are applied by dipping, brushing, and sometimes by spraying. If air drying varnish is used as an impregnant on coils not previously impregnated, the apparatus is usually preheated in an oven, dipped while hot in the varnish, and allowed to air dry at room temperature. In applications where time is an important factor, air drying varnishes are sometimes baked at temperatures in the neighborhood of 200 deg. F to accelerate the drying.

Baking varnishes are applied in general by three methods. The apparatus is sometimes brushed with the varnish but more often preheated and dipped or preheated and vacuum impregnated with the varnish. Of the three methods, vacuum impregnation gives the best results. By the utilization of the vacuum impregnation process, greater penetration and more thorough filling of the voids in the windings are obtained.

The equipment required consists of a tank for storing the varnish, an impregnating chamber, and the necessary pumping mechanism. In some cases the impregnating chamber is equipped with an exterior steam jacket to permit heating the entire unit. If the

preheating of the pieces is done in the impregnating chamber, extreme caution should be taken to allow the tank to cool before the varnish is brought into it, thereby avoiding the evaporation of solvents and the possibility of solidifying the varnish which is held in bulk.

To apply varnish by vacuum impregnation the coils are generally preheated in an oven for several hours or in the steam-jacketed tank as mentioned above. The pieces are then placed in a vacuum chamber, if heated in an oven, whereupon the tank is sealed and a vacuum of approximately 28 to 29 inches is drawn. When the coils have been evacuated for a sufficient length of time; the vacuum pump is shut off and the valve between the impregnating and the liquor tank is opened allowing the residual vacuum to draw the varnish from the storage tank into the impregnating chamber. Sufficient varnish is drawn into the impregnating chamber to cover all the pieces and the valve connecting these chambers is again closed. The equipment then is allowed to be immersed in the varnish for a length of time depending on the size and shape and mass of the windings. This immersion can take place either at atmospheric pressure by opening the lid of the vacuum tank or if abnormal pressures are desired, a pressure of approximately 80 pounds per square inch may be applied to the varnish while the impregnating chamber is still sealed. If abnormal pressures are desired, it is wise to use an inert gas such as carbon dioxide to avoid the danger of producing an explosive mixture of air and solvent in the tank.

Must Be Drained Well

After the immersion, the pieces can be taken from the varnish and drained in air from periods ranging from one-half to one hour. When the draining operation has been completed, these pieces should then be placed in an oven for a length of time and at a temperature prescribed by the manufacturer.

The most common method of applying impregnating varnishes is by preheating the coils in an oven and dipping them in the varnish while they are still hot. After the coils have been immersed for an appreciable length of time (usually until bubbling ceases) the pieces can be drained as before and baked in an oven. It is sometimes necessary to apply impregnating varnishes by means of brushing the varnish between layers of coil as the coil is being wound, then, when the winding is completed, place the coil in an oven and bake as prescribed.

Solvent Venting

Internal drying varnishes are particularly well suited to this application. These varnishes are also ideally suited to the rather unique process of applying several coats of varnish in rapid succession by the utilization of what is called the flash dip. This is done by treating the windings for the first application in the usual method and baking for approximately two hours. As many coats of varnish as desired can then be applied by immersing the windings and immediately withdrawing them which is called flash dipping and baking for two hours between fllash dips. The several coats of varnish can be cured in one final bake at the prescribed temperature for as long a time as necessary, which will generally be from 8 to 12 hours.

In the baking of an internal drying insulating varnish two things take place. First of all, the solvents are dissipated and when this has been accomplished, the resin is cured. It stands to reason, then, that the more rapidly we remove the solvents, the more quickly and more thoroughly curing will be obtained. In the care and maintenance of insulating varnishes, it is most important to use the solvents recommended to check the gravity and viscosity of the varnish, and to periodically clean the dip tank. It may sometimes be necessary to have the varnish cleaned by filter-pressing or centrifuging.

Thinning Agents

Insulating varnishes as supplied are usually heavier in consistency than required by the user and should be thinned before application. The first step is to determine the amount of solvent which must be added to produce the proper thickness of film. When this consistency has been determined, the density (specific gravity) at which this consistency is obtained should be measured by means of a hydrometer and thereafter the varnish maintained at this specific gravity. A hydrometer measuring liquids lighter than water should be used.

The solvent component of varnish is very volatile and upon exposure to air, evaporation takes place, altering the specific gravity which in turn affects penetration, drying time, etc. Therefore, the specific gravity should be checked at least once a day and if necessary, the required amount of solvent added to restore the gravity to the value deemed necessary for the work at hand.

The solvent and the varnish should be at approximately the same temperature and not less than 20 deg. C (68 deg. F).

Do not add the thinner too rapidly or in excess as curdling may result making it necessary to warm the varnish to bring it back to its normal state.

Check Specific Gravity

At the time that the specific gravity is measured the temperature should also be noted. The specific gravity of a varnish decreases as the temperature increases and vice versa. A temperature of 20 deg. C (68 deg. F) has been generally used for specific gravity measurements, but any temperature may be adopted for computing the specific gravity of varnish providing the same temperature is used for all measurements. Care should be taken to have graduates, hydrometers and other instruments warmed (or cooled) to the same temperature as the varnish.

It is quite possible that a varnish thinned repeatedly, even though it indicates the proper gravity, may show a lack of adequate filling and require a longer drying time. If such is the case, the varnish contains insufficient base and too much thinner of heavier gravity. To correct this condition, add more varnish as supplied by the manufacturer or allow the solvent to evaporate and use at heavier gravity than originally determined.

If a complaint on insulating varnish should arise, the things to be checked immediately are: the baking time, oven ventilation, baking temperature, the solvent used, specific gravity and viscosity of the varnish and the possibility of varnish contamination. These are the main causes of varnish difficulties, and by watching these items carefully varnish difficulties can be eliminated.

Benefits of Higher Voltages on Industrial Power Systems

Any contemplated major addition to, or revision of, existing low-voltage system will almost invariably furnish occasion for profitable raising of voltage to a higher level

D. L. BEEMAN, Industrial Power Section, General Electric Co., Schenectady, N. Y.

INDUSTRIAL POWER systems are modernized for many reasons, such as to replace inadequate switchgear, reduce maintenance, permit easier, lower-cost expansion, etc. It is not intended to discuss all these reasons here but to consider the use of higher distribution voltage levels when modernizing or expanding. Too low voltage is one of the most restrictive and costly bottlenecks in the expansion of industrial plant power systems.

Two classes of systems offer most opportunity for savings by changing to higher voltage. They are (1) power systems of several thousand kva. which now generate and distribute power at 600 volts or less, and (2) large power systems of several tens of thousands of kva. which now generate and distribute power at 2,400 volts.

The advantages of higher voltage generation and distribution are (1) plant expansion can be made at lower cost, (2) bottleneck caused by excessive short-circuit currents in lower voltage systems is removed, and (3) voltage drop is reduced.

Saving in cost of expansion is the most important advantage of a higher distribution voltage. To prove this point, let's take two cases (1) where there is enough existing generator capacity but a substantial increase in load is to be made, such as adding a new production unit, and (2) where both generating capacity and load are to be added.

The elements of a high voltage extension from a 4,160-volt bus to supply a 1,500-kva. load are shown as a new feeder in Fig. 1. This is a load center distribution system. The elements of a low-voltage (480-v) extension are shown as a new feeder in Fig. 2. The electrical equipment shown in solid lines below the bus in Fig. 1 costs approximately $18,600 and that shown in Fig. 2 $26,500. There is a saving of $7,900 or 30 percent in electrical equipment cost. The installation expense should be about a stand-off for the two schemes.

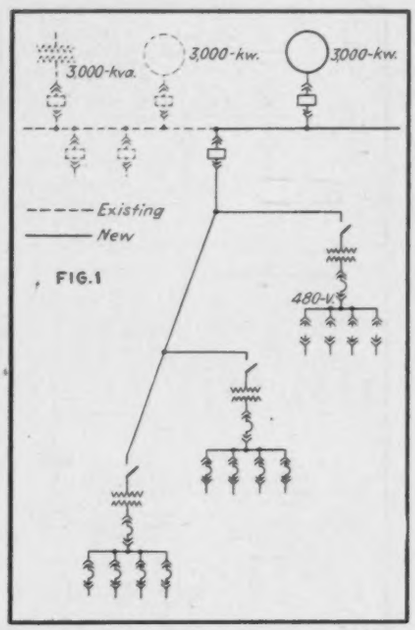


FIG. 1

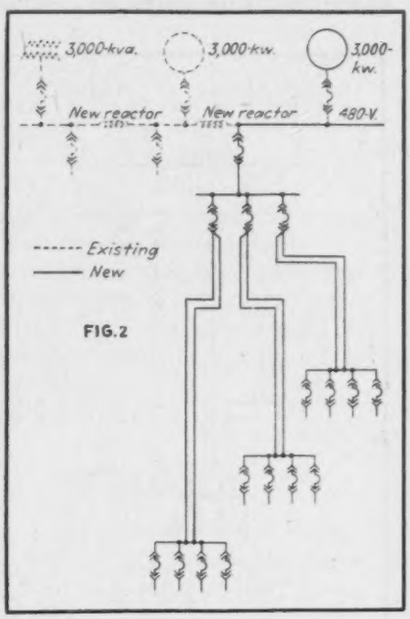


FIG. 2

480-VOLT EXPANSION costs more than 4,160. Fig. 1. Expansion of 4,160-volt system using load-center distribution, including addition of 1,500 kw. in new load (three 500-kw. load centers) and installation of new 3,000-kw. generator. Fig. 2. Same expansion as in Fig. 1, but at 480 volts bus potential.

Whether this 1500-kva. expansion is made all at one time or in steps over a period of years, the savings with higher voltage are just as great and the total amount of saving is the same.

For the second case, let us assume that a new 3,000-kva. turbine is added at the same time the 1,500-kva. of load is added. This will illustrate the second advantage of a higher voltage, namely, relief of the bottleneck of high short-circuit currents.

The short-circuit current on the existing 480-volt bus, Fig. 2, is about 100,000 amp., and that is the maximum interrupting capacity of available low-voltage air circuit breakers. Hence, when the new turbine is added, something must be done to limit the short-circuit current to 100,000 amp. One solution is to add current limiting reactors as shown in Fig. 2. This is acceptable only if existing breakers are modern and of adequate interrupting capacity. The reactors may add objec-

tionable voltage dip when starting a motor and require a major revision in the present bus and possible alterations to the building.

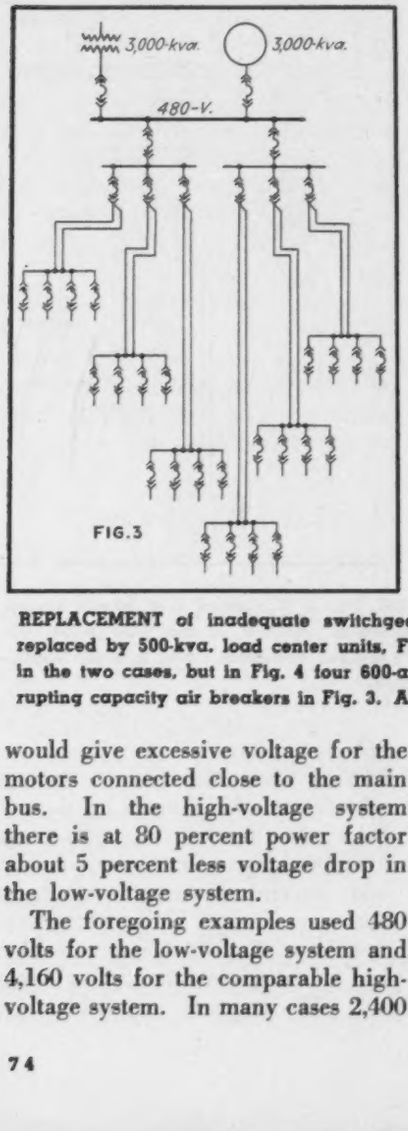
To get an economic comparison, we will take the setup as shown in Fig. 2 for the low-voltage (480-v.) scheme and the arrangement as shown in Fig. 1 for the high-voltage (4,160-v.) scheme. The new equipment (everything shown in solid lines) in Fig. 2 costs approximately $39,000 exclusive of the turbine-generator. This includes the bus tie reactors and $1,500 for the extra price of a 480-volt, compared with a 4,160-volt generator. The equipment (everything shown in solid lines) in Fig. 1 costs approximately $22,800. Here is a saving of $16,200 or 41 percent on this expansion.

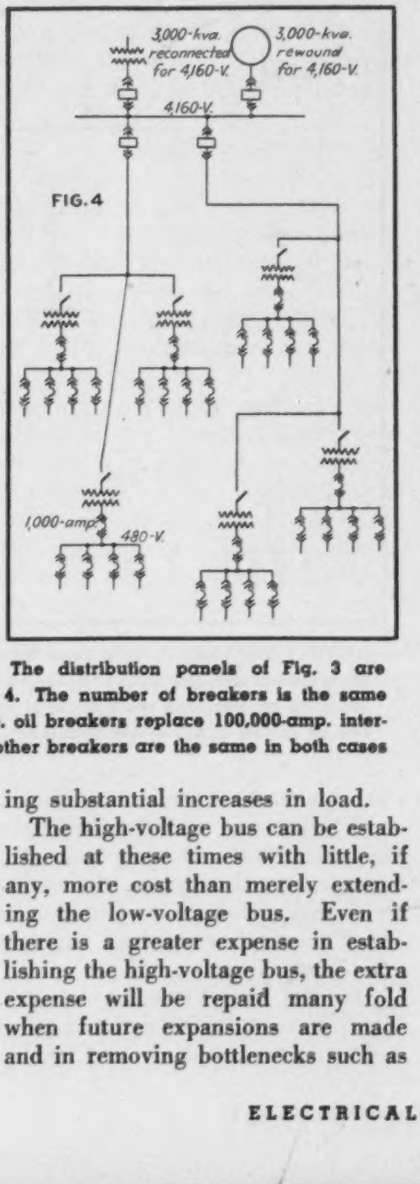
The voltage drop is less with the higher voltage system. The voltage regulators can be set to compensate for transformer drop. They cannot be set to compensate for feeder drop in the low-voltage system because that would give excessive voltage for the motors connected close to the main bus. In the high-voltage system there is at 80 percent power factor about 5 percent less voltage drop in the low-voltage system.

The foregoing examples used 480 volts for the low-voltage system and 4,160 volts for the comparable high-voltage system. In many cases 2,400 volts is too low, particularly where loads of the order of tens of thousands of kva. are encountered. Here the 2,400-volt system brings about the same problems and costly expansion as does 480 or 600 volts for load of the order of a few thousand kva. The example will not be repeated for a 2,400-volt system because the basic principles are the same.

The foregoing examples are hypothetical to show the advantages of higher voltage. In the system of Fig. 1, it was assumed that a high-voltage bus was already available. In the practical case that high-voltage bus must often be established because there is usually only a low-voltage bus available.

The best time to establish a new high-voltage bus is when one or more of these steps is contemplated (1) installing new switchgear, (2) installing new turbine, and (3) adding substantial increases in load.





REPLACEMENT of inadequate switchgear. The distribution panels of Fig. 3 are replaced by 500-kva. load center units, Fig. 4. The number of breakers is the same in the two cases, but in Fig. 4 four 600-amp. oil breakers replace 100,000-amp. interrupting capacity air breakers in Fig. 3. All other breakers are the same in both cases

The high-voltage bus can be established at these times with little, if any, more cost than merely extending the low-voltage bus. Even if there is a greater expense in establishing the high-voltage bus, the extra expense will be repaid many fold when future expansions are made and in removing bottlenecks such as the restrictions of high short-circuit currents.

Don't just add another feeder or transformer, or generator, or new switchgear, to a low-voltage system. Look ahead to see if a change in voltage won't pay real dividends.

Change When Replacing Switchgear

Many of the plants with extensive low-voltage generation and distribution systems are old and have switchgear which is not only inadequate from the interrupting standpoint but is unsafe and a hazard to production continuity. Here is an example of cost of replacement of switchgear at 480-volts compared with changing to a higher voltage and using load center distribution. Fig. 3 shows the low-voltage switchgear required and Fig. 4 the new equipment for the high voltage (4,160 v.) scheme. The former costs $73,000, and the latter $75,000. The latter cost includes rewinding the generator, reconnecting the transformer bank from 480 volts to 4,160-volts, unit substations, primary cable, and 4,160-volt metal-clad switchgear.

For a $2,000 investment *now* the short-circuit current bottleneck has been removed and the system is set up so that, when an extension is made, the cost of the extension will be 20 to 50 percent lower than with the low-voltage system. The example in Figs. 1 and 2 showed a saving of $7,900 for adding feeders to care for 1,500-kva. of new load.

When replacement of obsolete switchgear is contemplated, be sure to examine the savings that can be made in the future by changing to higher voltage and load center distribution now.

It is rare that a new turbine-generator is installed without adding new load, but even then it pays to go to a higher voltage. Suppose a new 3,000-kw. turbine is added to a 480-volt system and that nothing is done then to the existing 480-volt switchgear. To add the turbine at 480 volts requires a 4,000-amp. generator breaker position at $5,600 plus $1,500 premium for the low-voltage generator and about $2,500 for the bus and connections between the new generator and old bus. This totals $9,600. If the turbine is added at 4,160 volts, a 4,160-volt metal-clad generator breaker switchgear position is required, plus a trans-

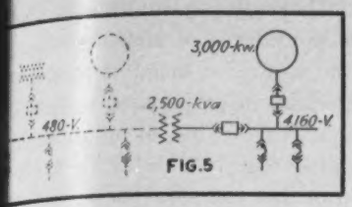


FIG.5

ING 4,160-VOLT generator to a 480- system costs more than installing a volt machine, principally because a tie nsformer is necessary. But the greater can readily be turned into a saving w load is added on the 4,160-volt bus

rmer for interconnecting the two es, Fig. 5. The transformer is sidered as part of the low-voltage . A new 4,160-volt metal-clad ker breaker is also required ahead the transformer. The equipment the 4,160-volt arrangement costs ut $15,600. This difference is 000, considerably less than the ing when new feeders for a load al to one-half the turbine rating added in the plant.

That picture is pessimistic. In rly every case the addition of h a large turbine to a low-voltage 0 volts or less) bus will require low-voltage switchgear for the sting 480-volt circuits because of increased short-circuit current ed by the new turbine. If new 0-volt switchgear is required, then will cost no more to change to igher voltage and load center dis- ution.

Do not add a new turbine to an sting low-voltage bus (600 volts less) without looking ahead to what can be saved when the next nt expansion comes.

When Adding New Load

Usually when new load is added, a main transformer and turbine added, but take the most pessi- tic view and assume generation 80 volts is available and that we add 1,500 kva. of load. This will just like Fig. 2 except we must a transformer and a 480-volt aker between the low- and high- tage (4,160-v.) addition now ts approximately $26,800 com- ed with $26,500 for the low-volt- addition. Even though this minates most of the saving due to h voltage, we have done two gs: (1) added the load with a l center distribution system, and) established a high-voltage bus ich puts the system on a basis so that any future expansions with the higher voltage (4,160-v.) will cost only 20 to 50 percent as much as future expansions at the lower voltage (480 v.).

Do not add new feeders to supply new load from an existing large low-voltage (600 volts or less) system without looking ahead to see what can be saved by using high voltage and load center distribution.

Step-by-Step Procedure

These examples show when and how to get started on a program of changing to higher voltage. To change a plant distribution system completely requires the following steps: (1) If new feeders or a new turbine or main transformer are being added, form a new high-voltage bus and connect all new circuits to the high-voltage bus and supply load through unit substations, (2) shift more load to the higher-voltage bus and supply this load through more load center unit substations, (3) rewind one of the larger lower-voltage generators and shift to higher-voltage bus, and (4) repeat steps 2 and 3 until entire system is modernized.

Too often it is said that "This is the last expansion that we will ever make, so what's the use of taking any steps to change to higher voltage?" The history of every progressive plant has been to use more and more electric power because electricity does more and more in a plant. Even though there are no new buildings added, the history of nearly every plant shows that more power is required. Don't delay making that change to higher voltage. Do it now so you can start reaping the benefits of lower investment, reduced voltage drop, and removal of bottlenecks due to high short-circuit currents in the industry's distribution system.

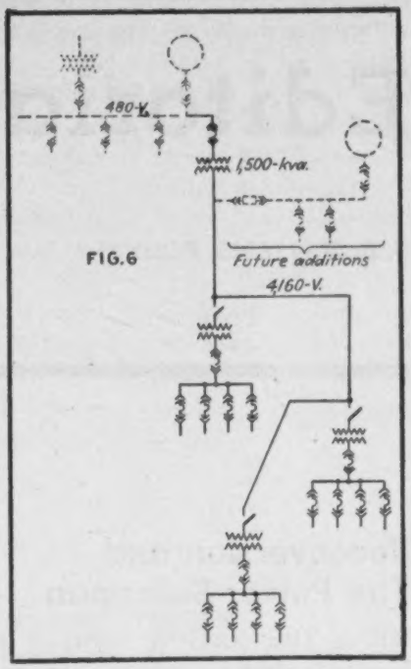


FIG.6

ESTABLISHMENT of high-voltage bus at time of load addition results in both present and future economies.

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Resuscitation by Seesaw Rocking

In a recent case of severe electrical shock the victim failed to respond to the Schafer method after 10 minutes of application. Meanwhile, a 3-foot fulcrum was being erected of handy concrete blocks and the victim was transferred to a stretcher which was centered over the fulcrum. As reported by the *Electrical Review* in an item by Dr. F. C. Eve in the British Medical Journal the respiration was reestablished after 20 minutes of cyclic rocking of a seesawed stretcher at a dozen times a minute through an angle of 45 degrees each way.

No time was spent in this case in tying wrists and ankles to the stretcher handles as, the wire mesh of the stretcher having bulged from use, the patient did not slip. Blankets had been placed above and below. Respiration failed again in the ambulance but soon responded to the Schafer treatment.

Dr. Eve advocates starting with Schafer's method at once on the ground. The body is blanketed and rolled on to the stretcher as soon as this can be brought, Schafer's method being continued while the ankles and wrists are bandgaged to the handles. The stretcher is then placed on the trestle and rocking is started by a full head-down tilt of 45 deg. The feet-down tilt is not started until fluid from the lungs or stomach has ceased to flow. Rocking is continued at ten double rocks a minute, i.e., 4 sec. head down, 2 sec. feet down. Warmth is essential to success.

Editorials

S. B. WILLIAMS, *Editor*

Reconversion and The Power Salesman

WHEN THE NATION undertook mobilization of its industrial plant for war, the big concerns snapped into line right away. They could learn quickly what was wanted of them and they had the managerial manpower to organize themselves rapidly for the war production job. But to get some 100,000 or more small manufacturers into war production was something else.

Here the electric utility power salesman distinguished himself. He explored and inventoried the facilities of his customers, piloted them through the unfamiliar ways of dealing with government, organized them into production pools, showed them what contracts they could undertake, helped them in every possible way to get going.

This performance of the power salesman was not casual improvisation. It was the result of thorough study of conditions and of thoughtful planning to meet them.

Approaches now the time when American industry will turn in considerable measure from war to peace production. Again the large concerns will have their plans all made, will know what to do and how to do it when the bell rings. And again the small manufacturers will need guidance, first to extricate themselves with whole skin from the tangle of contract termination requirements and next to get going on peace production.

There are plenty of indications that the electric utilities are fully aware of their responsibility to small manufacturers in respect of helping them to get started on peace production. Studies of markets and of possibilities of utilization of local resources are being made; utilities are generally in the local forefront of activities such as those of the Committee of Economic Development. It is the plain intention of the utilities to do all they can to keep their small industrial customers in business when peace comes.

But before these customers can get going on peace production they must pull themselves pretty well out from under their war contracts. Most of them will need right away whatever money is coming to them from war contract termination. They will require the same kind guidance through the procedures of unmaking war co tracts as they did in the making of them. Here is anoth job for the power salesman in preparation for which should now be studying every bit of information contract termination procedure he can lay his hands Data on peace-time products and markets won't mean thing to the small manufacturer if his capital isn't gott loose from war contract committments.

A Little That Will Help a Lot

HERE COME THE MARINES! The stoutly defend position is about to be relieved and the men who for long have plugged the dike with their fingers can look surcease from the strain. That's a fine mixture of me phors and maybe it's a trifle flamboyant for the conditi it describes. But it would be safe to risk a small bet th there are anyway a few engineers and operators who fe rather that way about the recently announced relaxati of restrictions on power system additions and improv ments.

OWU says that now a screen of a little larger mesh w be used in sifting applications for electric utility facilitie Some things that couldn't get through before now have chance. It becomes possible to think of new generati capacity in terms of fuel saving and of more comfortab margin of reserve. Improvement in service reliability an in voltage regulation and reduction of energy los emerge a little from the background of considerati where they were pushed by war. Maybe some of the o stuff that was jerked out of the far corners of utility wa houses and stuck in to hold the line can now be replace

The gate is not yet open. OWU makes that clear. On the topmost bar has been let down. There are still impo tant shortages in manpower and in lumber, steel and oth components that continue to restrict power system expa sion and betterment. Therefore only conditions that m urgently cry for attention should now be brought up f consideration.

An Opportunity in Public Relations

WHEN THE PACKAGES arrived "it was like Christm Day" and the men "snatched up" their contents. That w what happened when NEMA's Public Information Cent sent printed matter concerning the electrical industry two Navy hospitals in the New York area. "Just send

anything you have", the educational services officers had explained hopefully when asked what was wanted. "The men are avid for information about your industry", are interested in all its phases, including technical matters, the post-war electric home, the outlook generally and particularly in anything that suggests opportunities for jobs.

Scattered over the United States are nearly 500 libraries in Army, Navy and Merchant Marine hospitals, camps and bases. Believing that the men in these places would be just as interested in the electrical industry as those in the two Navy hospitals, NEMA sent to each of its members a list of the libraries, suggesting that individual manufacturers send to libraries in their areas all available information about themselves and their post-war plans—any on-hand copies of booklets, reprints and other informative material.

If that is a good idea for the electrical manufacturers, it should be a good idea for the electric utilities. NEMA will be happy to supply a copy of the list to any utility that wants it.

Obviously the libraries will not welcome a flood of worthless stuff and certainly they will resent any attempts to use them as channels of propaganda. However if librarians are consulted beforehand and their advice taken on what and how much material to supply, here is a wonderful opportunity for a worthwhile public relations investment that will return real dividends now and when the war is over.

Absorbing Magnesium Production

BEFORE THE WAR the entire production of magnesium in this country was only about 6,000,000 pounds. Aviation demands resulted in the establishment of additional producing plants and their total output for this year may exceed 500,000,000 pounds. That is an increase of more than 80-fold. How much of that can be absorbed in post-war peace-time utilization and how much of it will the electrical industry use?

Magnesium weighs less than one-fourth as much as iron and less than two-thirds as much as aluminum. That lightness is its greatest asset. Its drawbacks are low strength, readiness to corrosion (especially by salty water), limited temperature range, relatively low electrical conductivity and high coefficient of thermal expansion. But these can be overcome by alloying, by protective coatings and by appropriate application. The mere fact that there are so many workers now who have learned how to fabricate it and weld it will accelerate the disappearance of the former reluctance to use it. They are the employees of some 100 fabricators, the largest of which is the American Magnesium Corporation, a wholly owned subsidiary of Aluminum Company of America.

The airplane, automobile, truck and railway car all offer more or less natural uses for magnesium because they present the problem of the pay-load ratio. How much it invades the running gear and the chassis is a matter of relative cost but it appears that most of the applications will focus on areas above the floor line, where protection against corrosion can be sustained. Portable equipments like welders, conveyors, x-ray equipments, vacuum cleaners can benefit from weight reduction and that is true of a wide range of moving parts in machinery. Chemically, magnesium is a good dryer, deoxidizer and hydrogenator of oils.

In the electrical industry the rectifier plate, circuit breaker, meter disk, fuse, fan blade and high-torque induction motor rotor are all opportunities for cashing in on one of more of the unique properties of a metal to which war has given a startling uplift.

Electronic Penetration

JUST HOW DEEPLY and broadly has electronics penetrated the power systems? If the facts were more generally realized there would be more readiness to adopt electronic measures rather than take a stand-offish attitude based on mistaken notions of frailty, non-permanence and unreliability.

Carrier applications, mobile radio, rectifiers, photo-cell lighting control are familiar. Less common and consequently less familiar are a wide variety of controls, alarms and measurement procedures. There are also cases of electronic exciters, battery chargers and voltage regulators. Among the controls are those for motors, conveyors, combustion, temperature, circuit breakers, boiler pressure. Among the alarms and indicating functions there are the photoelectric guards, flow and level indicators, pressure and smoke indicators, speed and frequency indicators. In the field of metering there are applications to totalizing, meter testing, telemetering, speed and frequency recording.

Many of these uses have been reported in detail but many date back to days when electronics was, to the power engineer, largely a gimmick field inhabited by queer electrical engineers who preferred hugely large megacycles and triflingly small microfarads to the mere cycles and kilowatts of the established power art. That is all changed now and all it needs is admission that electronic devices do work consistently and can very advantageously be trusted to outdo longer standing methods or achieve things not before possible.

One of the geographical associations is reported to be studying this field for the sake of finding out what installations have been made and what their strong and weak points are. When it comes to electronic uses of energy and controls in productive industry it is going to be extremely helpful if the power salesman can tell the industrial electrical engineer how successfully the power industry itself has made use of them.

WASHINGTON COMMENT

By R. N. LARKIN, Washington Correspondent

MVA, More of the Same

DAVID LILIENTHAL, chairman of the Tennessee Valley Authority, is credited by some insiders with having drafted the Missouri Valley Authority bill which was introduced recently by Sen. James E. Murray, Montana Democrat. Whether or not he actually wrote the bill, Lilienthal had considerable influence upon its provisions, for the Murray empire would begin its operations with most of the powers which TVA worked out the hard way over a period of years.

The ink was hardly dry upon Murray's proposal before Sen. Guy Gillette, Iowa Democrat, introduced a measure largely identical with Murray's, but differing substantially on three points. Neither bill, of course, has yet been studied by the Senate Agriculture and Forestry Committee, nor is there much chance that either will be before election day. This being so, prospects that either will become law this year must be considered remote. The existing divergent ideas on how best to develop a nine-state region which constitutes more than one-sixth of the land area of the continental United States appear to be sufficiently ingrained to prevent agreement by both Houses to an entirely new proposal in the month and a half left to the 78th Congress after election day.

Clash with Ickes' Ideas

Prospects that either plan ever will become law must be unpleasant, or worse, to Interior Secretary Harold L. Ickes, who has extensive ideas of his own regarding the valley. These plans contemplate its development under Interior auspices, with emphasis on Interior objectives which vary appreciably from those professed by the Murray or Gillette bills. How extensively Ickes will oppose the Murray or Gillette bills, if at all, remains to be seen, but it is one of Washington's traditions that Ickes never quits trying, and the Interior Department's Sloan plan for the Missouri River valley calls for a program so extensive that control of the river would be worth considerable effort. Ickes is so fervent an irrigationist that it is hard to conceive of his acquiescing to any program which would begin to put the navigationist interests on a parity with irrigation.

To a less vehement extent, the same is probably true of the Army Engineers, exponents of navigationist thought on Missouri River control. The Engineers have long been powerful in Washington because of their jurisdiction over public works on rivers and harbors, and while their Pick plan for the Missouri has never been so grandiose as Interior's Sloan plan, creation of a Missouri Valley Authority, as proposed in either bill, would deprive the Engineers of a profitable territory. The Gillette bill would require that MVA pay considerable attention to Engineer plans for the river—one of its main points of difference from the Murray bill.

Page Mr. Norris

Notably, Murray refrained from attempting to enlist either Interior or the Engineers in support of his plan while it was under preparation.

Some proponents of the Murray bill insist that the measure is not an electric power bill, that power is but one of its facets—and by no means the most important. This might be accepted by the layman, but actually, the bill is an electric power bill from start to finish. Study of its provisions —or those of the Gillette bill—leaves it difficult to determine which of its other aspects is any more important than electric power. Navigation, irrigation and particularly flood control are all envisaged in both the Murray and Gillette bills, but the plans for these benefits are nowhere near so minutely spelled out as are the plans for establishment of a vast public power domain.

Ownership of the power facilities contemplated under either bill is not susceptible to much realistic debate, for if no MVA is authorized, there still remain the Pick and Sloan plans for tremendous publicly-owned power developments on the Missouri. Even if these plans were to be discarded, there would be little reason to believe that private capital could or would go into power development on the river to the extent which engineers of various government agencies believe feasible—a matter of 1,000,000-kw., plus dams, locks, canals, huge reservoirs and all the rest.

Again the False Whiskers

But much of the support which has been mustered for the Missouri Valley Authority has been drummed up on the basis that the primary and all-controlling purpose is flood control, with navigation and irrigation next in line. Study of the Murray and Gillette bills raises the question of why true flood control legislation should contain such broad and all encompassing provisions not only for the generation of huge blocks of power but also for financing the expropriation of existing private systems. There is no question but what the 6,000,000 inhabitants of the Missouri River Valley have as much right to publicly-owned electric power as to privately-owned power; but they are in the process of being sold public power in the form of flood control, plus navigation and irrigation, with some public generation thrown in to cut the costs.

If they buy flood control, they will do well to buy it in a package which will preclude their flood control protection from being distorted into extra hydro-electric power. Taxpayers of Oklahoma bought a specified amount of flood control when they approved Pensacola Dam on the Grand River in northeastern Oklahoma, but it wasn't there to use when the two worst floods in regional history occurred in May, 1943. This is not to say that the directors of the Missouri Valley Authority, as yet unnamed or even authorized, will as a matter of course flout control for power. It is to say that in view of the broad provisions for a vast regional power system which are contained in the two MVA bills, flood control is neither the sole nor the predominant issue, and electric power is not merely the incidental consideration implied by the language of the bills.

NEWS OF THE WEEK

U-1 Restrictions Relaxed by OWU in Supplement

Changes Effective This Week Expected to Cut Paperwork of Utilities 75 Percent—Inventory Distribution Program Scrapped—Delivery of Materials Need Not Be Scheduled Closely by Calendar Quarters

A widely-revised version of Order U-1 became effective this week along with similarly revised supplementary orders as the Office of War Utilities scrapped its inventory distribution program and removed requirements that deliveries of materials be scheduled closely by calendar quarters.

While few of the changes constituted any important relaxation in the standards governing the use of materials, it is expected that the new orders will reduce by about one-third the 3,600 applications made monthly on Form WPB-2774 and will reduce by 5,000 monthly the clearances sought by utilities from OWU's regional offices. Officials of some larger companies estimate that paperwork in connection with U-1 will be reduced by 75 percent as a result of the changes. Essentially, the amendments aim to allow automatic approval of as many as possible of the applications on Form 2774 which have been almost automatically approved when submitted.

Prime example of this was the increase from $1,500 to $10,000 in the allowable dollar value of "minor plant additions." Hereafter, projects within this limit may be undertaken automatically if they fulfill the requirements of Paragraph (1), except that lines not authorized by a supplementary order are not allowable under the new cost limit for minor plant additions.

The use of an AA-1 rating to purchase meters has been limited to purchases to replace defective units or to replenish the minimum allowable inventory. AA-3 ratings must be used for other purchases, under a change in Paragraph (b). Schedule A, listing electric material classes, has been amended to show specifically which materials may be purchased with AA-1 and which with AA-3 ratings for other than emergency use.

Schedule B has been deleted from U-1 in keeping with the revocation of Paragraph (e) (1). Material deliveries no longer need be scheduled by calendar quarters, since the overall limits on inventory are considered sufficient control. A new provision (E) (3) has been added prohibiting the purchase of any item if the item, or any workable substitute therefor, is available in inventory in excess of minimum requirements.

Paragraph (f) (1) has been modified to raise to $25,000 the limit under which restrictions on larger inventories do not apply. Utilities with inventories of this size need not maintain inventory accounts by material classes, but all purchases by such utilities are now subject to the provisions of Paragraph (g), forbidding orders beyond 90 days' supply.

In anticipation of a forthcoming change in Order L-41, governing construction, a new Paragraph (i) (5), has been added, governing alteration or construction of buildings by electric utilities. The new paragraph requires that utilities conform to Paragraph (e) and to Appendix I, both of Schedule A to CMP Regulation 6, whenever materials and labor cost of a construction or alteration job exceeds $800. Under this procedure utilities will apply on Form 2774 whenever cost of materials for alteration or construction exceeds the $10,000 minor plant addition clause or when a structural design or material restricted by L-41 is desired.

A new exception to Paragraph (f) (7) allows the ordering of any material in its minimum procurable commercial quantity, regardless of the 90-days' supply restrictions.

Utilities need no longer keep continuing records of or report excess inventories since Paragraph (g) (2) has been deleted, as has been Paragraph (l) (1). These deletions remove the requirement that utilities must offer for sale or sell any material in excess inventory, but the requirement that such material must be sold to another utility for repair of breakdowns is retained.

Inter-Utility Sales Simplified

Regulations for sales of materials by utilities in Paragraph (k) have been simplified, and sales may be made independently of priorities Regulation 13. Sales between utilities of any materials may be made without preference rating or allotment number. Sales of used equipment by utilities to non-utilities may be made without rating or allotment number subjected to other WPB regulations. Sales of new equipment and controlled materials to non-utilities may be made under PR 13. As PR 13 is changed, utilities who choose to use its provisions may make any sale authorized therein.

The inventory control plan has been scrapped by deleting from U-1 the requirements that purchases of certain items be cleared with regional utility engineers before orders are placed. Paragraph (m) and Schedule D are among the provisions which have been deleted.

Paragraph (s) has been amended to conform to the elimination of the requirement that deliveries be scheduled. Specific quotas for scheduled deliveries which may have been established are revoked.

Under a new Paragraph (t), utilities may use ratings and allotment numbers assigned in Paragraph (b) and (c) to obtain construction materials for jobs approved on Form 2774 prior to the

effective date of the new order where the cost is between $1,500 and $10,000.

The increase to $10,000 in the value of allowable minor plant additions has been included in Supplementary Orders U-1-a, U-1-d and U-1-f. The dollar value limitation on line construction heretofore included in Order U-1-c has been deleted as unnecessary in view of the 5,000-foot per quarter limit. The $1,500 limitation has been retained in Orders U-1-g, governing temporary construction, and U-1-i governing lines to irrigation projects.

In all supplementary orders, the restriction requiring that no line be built if another source can render service with less critical materials has been deleted in conformity with OWU's "first-come-first-served" policy, as well as because it is difficult to determine just how much material another source might use.

A slight relaxation in conductor standards has been included in U-1-c by changing Paragraph (a) (5) (i) to allow the use in secondary lines of conductor having conductivity equivalent to that of No. 4 copper. A new provision requires that secondary extensions up to 750 feet in length be used in preference to installation of another transformer except when voltage drop in such extension would be excessive.

Extensions of service to commercial consumers under U-1-d are now restricted to 1,000 feet, and the definitions of domestic, commercial and industrial consumers in U-1-f have been included in U-1-d. Paragraph (b) of U-1-d allows extensions to farm dwellings built or remodelled under L-41 according to utilities standards.

Revisions of the housing utilities standards include a reduction of the minimum spacing between street lights from 500 to 350 feet and an increase to 1,000 feet of the allowable extension where a builder's application is for construction or alteration of one to three structures. Without the latter change, it would have paid persons seeking service to evade L-41 and get a longer extension under U-1-f than was allowable under U-1-d.

In U-1-f, Paragraph (b) (5) now becomes (b) (4), with clarifications to show that even though adequate service for electric cooking or water heating is in place, it does not outlaw extension of gas facilities for either of these purposes. Conversely, the existence of adequate gas facilities for either purpose does not preclude extension of three-wire electric service.

Allowable extensions to domestic or commercial consumers under U-1-f has been increased to 1,000 feet, except that in domestic extensions, no additional transformers may be used unless the service is for operation of an electric range, refrigerator or washing machine already owned by the customer.

No changes of importance were made in U-1-g and U-1-i. U-1-h was revoked, since the field it was designed to cover is now covered by the $10,000 ceiling on construction added to U-1-d.

Paragraph (c) of Direction 2 to U-1 also has been revoked as no longer necessary with the revocation of Paragraph (m) of U-1.

LOOKING AHEAD.—M. M. Boring, General Electric engineer from Schenectady Works in charge of placement of test engineers, addresses a group of 50 such engineers at the company's Pittsfield Works, on war conditions and future peacetime prospects. The need for technically trained men in important posts was stressed. L. to r., C. H. Kline, Mr. Boring, L. R. Pierce, A. A. Tillau, W. S. Fielding and John Chamberlain

U-1 Revision Brings Personnel Reduction

The Office of War Utilities will dispense with its 13 regional engineers and their staffs, totalling about 40 people, by September 30 in accordance with the revised version of Order U-1, effective this week, which terminated with inventory redistribution program.

When the regional staffs have been liquidated, utilities seeking small distribution transformers will make application to OWU in Washington rather than to its field offices. Orders for domestic watt-hour meters, however, will continue to be placed with WPB regional offices since Order L-151, governing meters, is a WPB order rather than strictly an OWU order.

OWU's inventory control branch at Washington will not be affected by the termination of the regional staffs and will continue its work on inventory matters under the new U-1. In addition, the branch is concerned increasingly with problems relating to disposition of war surplus materials of interest to utilities.

The Washington inventory control branch may issue a catalog listing major items remaining in excess inventory for the guidance of utilities which care to continue inter-company purchasing.

A report on the 18 months achievements of the inventory redistribution program, which began April 1, 1943, is expected to be issued by September 30. It will probably show reductions in excess inventories of electric, water and gas utilities in the neighborhood of $40,000,000, or almost half the material listed as excess when the program began.

The program has been terminated as having reached the point of diminishing returns and as having moved most of the material which is at all readily movable.

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Inspectors Discuss Bad Wiring Results

Damaging effects of inadequate wiring caused by lack of material and depleted electrical inspection staffs were discussed at the 18th annual meeting of the Northwestern Section, International Association of Electrical Inspectors, held Aug. 21-23, at Olympia, Wash. Revisions of the National Electrical Code were also approved.

Fire was pointed out as the main danger brought about by inadequate wiring, by J. D. Lynett, supervising chief inspector in New York City and international president. He said

hat fire losses in New York were nearly hree times as great after the first World War as they were previous to it nd predicted that the same trend may e expected after the end of the present onflict.

Officers elected were Harry Hilpert, lectrical inspector of the State of Washington, president; C. S. Alger, Puget Sound Power & Light Co., Seattle, first vice-president; R. J. Larrabee, Underwriters Laboratories, Seattle, second vice-president; W. H. Gaffney, electrical inspector, Tacoma, secretary-treasurer; C. M. Kirsop and W. R. Volheye, representatives on the I.A.E.I. Executive Council; and L. W. Going and W. H. Gaffney, section delegate and alternate on the Electrical Committee.

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WPB Asks for Inventory of Fluorescent Light Parts

WPB has moved to determine inventories of fluorescent lighting fixture ballasts and transformers by requiring manufacturers and assemblers of fluorescent fixtures and electrical wholesalers selling ballasts and transformers to report stocks on hand, the number used and the number on order for 1944.

Reports are due on or before September 15 and are to be filed on form WPB-3894 by manufacturers, assemblers, and wholesalers who on September 1 will have on hand 100 or more units of all types of ballasts and transformers or who used 500 or more units in 1944 or who had on order 500 or more units this year.

The information is necessary to determine whether present production of these items is sufficient for essential fluorescent lighting installations.

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Associated Gas Assets Are Down to $115,000,000

Assets of the Associated Gas & Electric system have shrunk to $115,000,000 in contrast to the $258,000,000 face value placed on the outstanding debentures, Federal Judge Vincent L. Leibell revealed last week when he approved a reorganization plan already sanctioned by the Securities and Exchange Commission.

Under the proposed plan the unsubordinated creditors of the Associated Gas & Electric Corp. and of the Associated Gas & Electric Co. will receive cash and new securities; the subordinated creditors or stockholders receive nothing. The agreement will be resubmitted to the court after the creditors of the system have approved it.

Federal Officials Seeking Stay of Power Injunction

Join San Francisco in Search for Solution to Disposal of Hetch-Hetchy Output—Compromise Plan Submitted by City Is Rejected as Violation of Raker Act—Pacific Gas Facilities May Be Leased by City

Federal officials joined the city of San Francisco this week in seeking a further stay of the injunction halting the city's sales of electric energy from the Hetch-Hetchy project to the Pacific Gas & Electric Co. after Acting Interior Secretary Abe Fortas rejected a compromise plan submitted by the city.

Fortas and Mayor Roger D. Lapham agreed on a new step in the controversy, which has existed since 1937 when Interior Secretary Harold L. Ickes sought to halt sales to P.G.&E. but which flared to new proportions early last month when aluminum production at the Defense Plant Corporation's Riverbank, Cal., plant was cut off. The next step will be for the city to seek an "agreement with P.G.&E. for the use, in return for a cash payment, of certain of the company's facilities through which municipally-owned energy could be supplied for facilities of the city and to customers of the city, whether within or without the limits of the city and county of San Francisco." The city now has only one customer other than itself.

Surplus Output a Problem

It was apparent that under the new proposal, the difference between the 500,000,000 kw.-hr. generated annually at the municipal plant and the 200,000,000 kw.-hr. required annually to serve city load would have to be sold to Pacific Gas customers by the city or not generated.

Rejected by Fortas, on advice of the Justice Department in which Interior concurred, was a city proposal that the city deliver the entire Hetch-Hetchy output to P.G.&E. at Newark substation, in return for which the company would serve the entire city load of approximately 200,000,000 kw.-hr. yearly and would furnish, maintain and operate all street lighting facilities and render certain other similar services.

Fortas rejected the proposal with the comment:

"It is perfectly clear that with the city generating for delivery at Newark 500,000,000 kw.-hr., and with only approximately 200,000,000 kw.-hr. needed for the city's purposes, the balance of approximately 300,000,000 kw.-hr. would be delivered to P.G.&E. for its own uses, and for sale or resale in violation of the Raker Act."

Under the terms of the Raker Act, passed by Congress in 1913 allowing the city to use waters rising on federal land, the city is prohibited from ever selling or letting to any corporation or individual the right to sell or sublet the energy given it by the government.

"I have no alternative but to conclude that the proposal now submitted would not result in the disposal of Hetch-Hetchy power in compliance with either the letter or the spirit of the Raker Act," Fortas said. "I find no room whatever for any other conclusion, looking at the proposal as a whole."

Mayor Lapham announced that his delegation would return to San Francisco "and do our utmost to work out something along the lines contemplated." Extension of the stay of injunction beyond its expiration date of August 28 was the first task at hand.

It is estimated that in the neighborhood of 40,000 kw. of capacity must be disposed of by the city to fulfill the plan suggested by Fortas and agreed to by Mayor Lapham. In the absence of any new loads of any sizeable proportions scheduled for the San Francisco area, it became apparent that the city would either have to shut down its plant to the point at which it generated solely for city load, or persuade Pacific Gas & Electric to give up about 40,000 kw. of load to the city.

In announcing that federal officials would assist city attorneys seeking a further stay of injunction. Fortas announced that the present proceedings are the "last round" of the controversy. He said the city remains free to develop any solution which complies with the Raker Act, whether it involved condemnation proceedings, issuance of revenue or other type bonds, agreement or any other settlement.

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Fire Severs Power Line

Fredericton, N. B., and its suburbs were without power for nearly a week recently when a forest fire of two weeks' duration destroyed about three miles of the transmission lines connecting the area with the Grand Lake steam power plant of the New Brunswick Electric Power Commission.

More Refrigerator Parts Asked of WPB

Domestic Laundry Manufacturers Also Await Reconversion Order

Manufacturers of domestic laundry equipment and mechanical refrigerators have asked the War Production Board to allow the accumulation of inventories of washing machine and refrigerator parts against the time when civilian production of these appliances can be resumed.

Neither washing machines nor mechanical refrigerators may be made under WPB's "spot authorization" program for the resumption of civilian production. WPB officials told the industry committees that provision has been made for increased production of washing machine repair parts and that a similar program for mechanical refrigerator parts is planned. Production of each of these has already shown a 50 percent improvement over the output of last year.

Industry members suggested that in building up parts inventories emphasis should be laid on those parts requiring the greatest "lead time". They pointed out that assembly cannot begin until an inventory of all components has been accumulated. A shortage of fractional horsepower electric motors because of the big bomber program has precluded production of mechanical refrigerators and washing machines under the "spot authorization" program.

Would Speed Civilian Goods

Committee members said six to nine months would be required by plants now engaged in war work to resume 50 percent of their normal civilian production. This time can be greatly shortened by the accumulation now of parts which could be made under the new program. In addition, sandwiching of civilian production into war output schedules would minimize dislocations due to cutbacks and would allow time for retraining workers, members said.

The committees recommended also that 30 days' notice of impending cutbacks be given manufacturers, that motor manufacturers be allowed to produce motors for refrigerators and washing machines wherever possible provided that military requirements are met, and that possibility of forming consumer goods production pools, by which a limited number of refrigerators and washing machines might be made, be studied.

Shortages of thermostatic controls and sheet steel also preclude immediate production of refrigerators and washing machines.

Leland Olds Is Approved

The Senate Interstate Commerce Committee last week reported favorably the nomination of Leland Olds for reappointment to the Federal Power Commission. No debate or vote on the reappointment had been engaged in as this issue of ELECTRICAL WORLD went to press. It was believed that none would take place until after Labor Day.

A sub-committee held three days of hearings on the Olds nomination early in July and recommended conformation by a 3-2 vote.

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P.U.C. Won't Reconsider P.E.P. Co. Rate Reduction

Petitions by the U. S. Treasury Department's Procurement Division and the Federal Works Agency for reconsideration of its order reducing Potomac Electric Power Co. rates by $1,037,000 yearly were denied this week by the District of Columbia Public Utilities Commission.

The Commission had earlier rejected a plea for reconsideration by P. E. P. Co. It was not indicated immediately whether the two Federal agencies would appeal the order to the District Court of Appeals as did the company when its petition for reconsideration was rejected.

Counsel Thurman Hill of the Procurement Division told the Commission that the company owed its "profitable record almost entirely to the government," and added that the company showed "poor grace" in appealing the decision. P. E. P. Co. charged the Commission had acted on a "unilateral" basis in changing the sliding scale agreement without getting the consent of the company.

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Arkansas Power Reveals Refinancing Plan Details

Details of the proposed refinancing program of the Arkansas Power & Light Co. were revealed in an application recently filed with the Arkansas Department of Public Utilities seeking authority to issue 1,070,000 shares of $12.50 par value common stock. Electric Power & Light Corp., parent company, will get the stock in exchange for $4,000,000 and 7,697 shares of A. P. & L. $7 preferred stock and 1,233,638 shares of no par value common stock.

Although the refunding plan will proceed, the company still will appeal to the Arkansas Supreme Court the ord of the Department of Public Utiliti ordering the $975,000 rate reduction a charge-offs which the refinancing see to carry out, President C. H. Mo said.

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Proposes That Congress Give REA $700,000,00

A proposal for an additional $70 000,000 grant by Congress to the Rur Electrification Administration for t construction of new rural electric lin over a 5-year post-war period has be made by the planning committee of t National Rural Electric Cooperati Association following a two-day mee ing with the association's executi committee at St. Louis.

This grant would permit the co struction of enough new electric lines provide electricity to 80 percent of t nation's farm homes. The proposal w approved by the executive committ and will be submitted to the REA.

E. J. Becker, chairman of the co mittee, said the proposed constructio would provide work for 380,000 m years. The committee adopted anoth resolution favoring the employment war veterans for all phases of the co struction program.

The REA, which halted its mass co struction activities in July, 1942, b cause of a shortage of critical material has on file completed applications f $49 million of new construction f which loan allotments have been ma from previously appropriated funds. I addition the agency has on file oth applications for loans totaling mo than $113 million.

E. J. Stoneman, head of the associ tion's executive board, praised the re ord made by the 879 borrowers fro the REA. He said that Congress h made available approximately $52 000,000 for rural electrification sinc 1935, of which $501,000,000 has be allocated. Although only $60,000,000 REA loans has become due, the rur electric cooperatives have already pa back $77,000,000, many making a vance repayments on their loans.

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Duke Co. Buys Property

Duke Power Co. has purchased th former Magnolia Mills property, co sisting of a large mill building an several acres of land, adjacent to i Charlotte, N. C. substation at a pric believed to be $30,000. The propert will enable the power company to ex pand the substation.

Niagara Falls Power Control Rule Ended

One of the first war power orders, L-46, which provided for close control over load growth in the Buffalo-Niagara Falls industrial area and set standards for curtailment in the event of a power shortage—was revoked this week by the Office of War Utilities as no longer necessary.

The order was instituted Feb. 27, 1942, after a series of ice jams had cut into perilously low reserve capacity margins and forced the dropping of customers. The plan for regulated curtailment which was embodied in L-46 never had to be put into effect after the order was issued, and the order's principal use to OWU was in the strict control it gave the war agency over load growth on the 25-cycle interconnected system serving the area. Under the order, no new loads or no load increases over 100 kw. were allowed without specific WPB permission.

The order made mandatory an interconnection which already existed on the 25-cycle system maintained by the Niagara Falls Power Co., the Niagara Lockport & Ontario Power Co., the Buffalo Niagara Electric Co., the Rochester Gas & Electric Corp. and the New York State Electric & Gas Corp. In addition to providing a schedule of consumers who were to be cut in time of emergency and another stating customers who must be served at all costs, the order provided for a 50-percent cut in deliveries to non-exempt customers in time of emergency and a schedule for reducing deliveries to industrial customers of Niagara Falls Power Co.

Since the order was instituted, the peak load for the area has dropped by about 50,000 kw., and reserves have increased almost to 100,000 kw., with an arrangement in effect whereby Canadian sources can furnish 50,000 kw. of 25-cycle energy in emergencies. Future ice jams are minimized by a weir erected above the falls. No new loads of consequence are anticipated in the region; so the need for L-46 control has vanished. If such need returns, OWU officials point out, it can be handled under Order L-94, which provides for power curtailment anywhere in the country.

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Will Give Wiring Advice

A wiring advisory service for home builders will be established by the Alabama Power Co. just as soon as the war is over, chiefly to see that wiring installed in new homes is ample for present and future loads, according to a recent announcement by the company.

Diversion of High-Grade Coal Will Affect Utilities

Coke Plants and By-Product Users Whose Stocks Have Fallen Are to Get 1,680,000 Tons of Special-Purpose Coal—Utility Stockpiles Will Be Reduced—Steel Plants to Be Given 30-Day Reserve Stocks

Electric utilities and other industrial plants using high-grade, special-purpose coals for steam generation will lose most of the 1,680,000 tons of this fuel which must be diverted at the mine to coke plants and by-product users whose stocks have fallen to dangerously low levels, it appeared this week as the Solid Fuels Administration for War studied order boards of mines in Districts 7 and 8 to determine where diversions should originate.

Utilities and other industrial users appeared most likely to suffer diversions since they, on a nation-wide basis, hold bituminous stocks well above the levels aimed at as normal in SFA Regulation 10. Some of the diversions are expected to come from the proceeds of the 10 percent cut ordered some time ago in deliveries of Districts 7 and 8 coals for domestic use. No further cut of civilian allocations of these coals is yet anticipated, however, the SFA statement said in announcing diversions.

The diversion program is necessary to protect steel production and by-product users, Acting Interior Secretary Abe Fortas said. It is expected that the diversions will be made from well-stocked purchasers so as to minimize the necessity for allocating replacement coals and to protect against bleeding of purchasers whose stocks are at or below the minimum levels aimed at in Regulation 10.

Coking Plants Have Priority

The 1,680,000 tons which will be diverted is expected to be sufficient to raise stocks of coking plants and by-product users to 30 days, the minimum level sought for this class in Regulation 10. These users have priority over electric utilities and other industrial users under the regulation.

SFA pointed out that some steel plants have only a few days' supply of coal, and that the average of 30 plants whose stocks are inadequate is 15 days' supply. It is hoped to complete the diversions by the end of this year.

Some observers considered it possible that much of the diverted coal will not be replaced. To the extent that this is the case, stockpiles of utilities and other industrial users would be reduced from present levels.

Most recent reports showed the electric industry to hold an average of 80 days' supply nationally. This is double the 40-days' normal minimum aimed at in Regulation 10. Other industrial users, with an average of 56 days' supply, hold nearly three times the 20-day Regulation 10 minimum for their class. Thus, since the good coals which would be sought as a replacement for diverted special-purpose coals are still scarce, decision might be not to replace diversions of coal from Districts 7 and 8, but to lower stockpiles of well-supplied users. This would ease SFA's job appreciably, for many diversions start a chain of replacement directives.

If replacements are minimized, electric companies with low coal stocks will probably lose little if any coal through the diversion program, but well-supplied companies might lose an appreciable number of days' supply.

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H. Marks Sent to London

Herbert Marks, counsel of the Office of War Utilities and former head of the old Power Division, has been sent to London to assist the staff of the Combined Public Utilities Committee, the joint British-Canadian-American off-shoot of the Combined Production and Resources Board which is assisting the military forces and the United Nations Relief and Rehabilitation Administration in restoring utility services in recaptured areas. Marks' assignment is expected to keep him in the United Kingdom for several months.

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Turbine Order Revoked

Schedule VI of order L-154, governing auxiliary equipment for land steam turbines, has been revoked by the Office of War Utilities.

Manufacture, delivery, and installation of land steam turbines remains subject to all other applicable WPB orders and regulations. Revocation of Schedule VI was carried out because the demand for turbines has decreased rapidly in recent months as petroleum and synthetic rubber projects which required many turbines were completed.

Grange Opposes Bill Protecting Utilities

Contending sections of the rivers and harbors bill now pending before the United States Senate would deprive the public of the right to cheap electric power from government reclamation projects, Grange masters of five western states passed a resolution opposing the bill in its present form at a recent conference in Portland, Ore.

States represented by the action are California, Oregon, Washington, Idaho and Montana. Sections of the bill referred to read in part:

"The secretary of the interior is not authorized to construct or acquire transmission lines in competition, direct or indirect, with any existing company operating transmission lines for the sale of electric power . . ."

According to George Sehlmeyer of Sacramento, California State Grange master, opposition is based on the assumption that should the bill become law, energy generated at government projects such as Shasta Dam, Boulder Dam and Grand Coulee Dam would have to be sold at the power plants to private utilities for resale to the public.

In the same vein, Grange masters of California, Oregon, Washington and Montana, adopted a resolution urging that all projects affecting power and irrigation development be dropped from the Army engineers flood control bill. The resolution stated that the bill would serve to prevent development of public power distribution from projects constructed under its provisions.

Grange leaders declared it was their belief that all federal irrigation and power dams should be constructed by the Bureau of Reclamation or a similar authority.

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Former Union Electric Co. Head Gets Prison Release

Louis H. Egan, 62 years old, former president of the Union Electric Co. of Missouri, who was sentenced to a two-year prison term, having been convicted of a charge that he entered into a conspiracy to violate the 1935 Federal Public Utilities Holding Company Act, was released on September 1, the Federal Bureau of Prisons in Washington has announced.

Egan, a prisoner at the Terre Haute, Ind., Federal prison, became eligible for parole on August 28 with the completion of one-third of his term. Entering the prison on December 29, 1943, he spent practically the entire eight months in the prison hospital, suffering from a heart ailment.

Mr. Egan plans to return to St. Louis and remain under a doctor's care. His condition is such he will not be able to engage in business.

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Books of Central States Are Ordered Reopened

Reopening of the transfer books of preferred stock of the Central States Electric Corp. is provided for in an order by Judge Robert N. Pollard of the Federal District Court at Richmond recently.

The court designated the Manufacturers Trust Co. of New York as transfer agent with authority to transfer 7 percent preferred stock, issue 1912; preferred stock, 6 percent series; convertible preferred stock, optional dividends series; convertible preferred stock, optional series 1929.

The Irving Trust Co. of New York was reinstated as registrar for the 7 percent preferred stock and the Central Hanover Bank & Trust Co., New York, was reinstated for the remainder.

Building Coulee Drydock

A circular drydock housing a caisson to be used in inspecting and maintaining the floor of the Grand Coulee Dam spillway is now under construction. Bureau of Reclamation engineers say it is the largest of its architectural style yet undertaken. Instead of excavating to bedrock, the engineers began construction on ground level. As the drydock increases in height, the inside muck is removed permitting the drydock to sink.

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To Write off Excess Cost

South Carolina Power Co., an associated company of Commonwealth and Southern Corp., will eliminate from its electric plant accounts net amounts totaling $8,815,924.28 representing excess over original cost. The disposition of over $6,000,000 of the total is to be effected immediately by charges to earned or capital surplus, and the major portion of the remaining amount is to be amortized over a 15-year period commencing as of July 1, 1944.

MEETINGS

Indoor Climate Institute—Open forum on conservation and post-war planning, Book-Cadillac Hotel, Detroit, Mich., September 21-22. R. E. Moore, secretary, Penobscot Bldg., Detroit 26, Mich.

Previously Listed

International Association of Electrical Inspectors—Western section, Claypool Hotel, Indianapolis, Ind., September 11-13; F. H. Moore, secretary, 320 N. Meridian St., Indianapolis, Ind. Eastern section, DeWitt Clinton Hotel, Albany, N. Y., September 18-20; F. N. M. Squires, secretary, 85 John St., New York, N. Y. Southern section, Ainsley Hotel, Atlanta, Ga., September 25-27; A. M. Miller, secretary, 219 Governor St., Richmond 19, Va.

Edison Electric Institute — Accident prevention committee, E.E.I. headquarters, New York, N. Y., September 12-13; prime movers committee Wm. Penn Hotel, Pittsburgh, Pa., October 2-3; electrical equipment committee, Schenley Hotel, Pittsburgh, Pa., October 5-6; transmission and distribution committee, Hotel Statler, Buffalo, N. Y., October 9-10. Col. H. S. Bennion, managing director, 420 Lexington Ave., New York 17, N. Y.

Illuminating Engineering Society—Annual convention, Edgewater Beach Hotel, Chicago, Ill., September 14-16. A. D. Hinckley, executive secretary, 51 Madison Ave., New York 10, N. Y.

Indiana Electric Association—Annual fall meeting, French Lick Springs Hotel, French Lick, Ind., September 20-22. E. F. Hauser, secretary-treasurer, 1414 Circle Tower, Indianapolis, Ind.

International Association of Electrical Leagues—Annual conference, Book-Cadillac Hotel, Detroit, Mich., September 20-22. O. C. Small, secretary, 155 E. 44th St., New York 17, N. Y.

Southern Electric Exchange—Engineering and operation section, Roosevelt Hotel, New Orleans, La., September 21-22; sales conference, Henry Grady Hotel, Atlanta, Ga., November 9-10. J. W. Talley, executive secretary, 303 Haas-Howell Bldg., Atlanta 3, Ga.

Maryland Utilities Association—Mid-year meeting, Lord Baltimore Hotel, Baltimore, Md., September 22. R. C. Brehaut, secretary, 1100 H St., N.W., Washington 1, D. C.

Association of Iron and Steel Engineers—Annual meeting, Wm. Penn Hotel, Pittsburgh, Pa., September 25-27. Brent Wiley, managing director, Empire Bldg., Pittsburgh 22, Pa.

Municipal Electric Utilities Association of New York State—Annual meeting, DeWitt Clinton Hotel, Albany, N. Y., September 26-27. T. J. McKee, secretary, 200 E. Third St., Jamestown, N. Y.

National Electrical Contractors Association—Annual meeting, French Lick Springs Hotel, French Lick, Ind., October 1-5. L. W. Davis, general manager, 633 Investment Bldg., 15th and K Sts., N.W., Washington, D. C.

International Municipal Signal Association—Annual meeting, Hotel Statler, Boston, Mass., October 2-5. Irvin Shulsinger, secretary, 8 E. 41st St., New York 17, N. Y.

National Safety Council—Annual congress, Sherman, Morrison and LaSalle Hotels, Chicago, Ill., October 3-5. N. H. Dearborn, managing director, 20 N. Wacker Drive, Chicago, Ill.

National Electronics Conference—Medinah Club of Chicago, 505 N. Michigan Ave., Chicago, Ill., October 5-7. Beverly Dudley, secretary, 520 N. Michigan Ave., Chicago 11, Ill.

Electrochemical Society — Fall meeting, Hotel Statler, Buffalo, N. Y., October 12-14. Colin G. Fink, secretary, Columbia University, 300 Broadway, New York, N. Y.

American Welding Society — Annual meeting, Hotel Cleveland, Cleveland, Ohio, October 16-19. Miss M. M. Kelly, secretary, 29 West 39th St., New York 18, N. Y.

Pennsylvania Electric Association—Electrical equipment committee, Johnstown, Pa., October 19-20. A. N. Shealy, chairman, Pennsylvania Water & Power Co., Lexington Bldg., Baltimore, Md.

Engineers Council for Professional Development—Annual meeting, Engineering Societies Bldg., New York, N. Y., October 20. S. L. Tyler, secretary, 29 W. 39th St., New York 18, N. Y.

National Electrical Manufacturers Association—Annual meeting, Waldorf-Astoria Hotel, New York, N. Y., October 23-27. W. J. Donald, managing director, 155 E. 44th St., New York 17, N. Y.

Energy Output Curve Moves Downward

Reversing the upward trend, which set in early in July, the output curve during the week ended August 26, 1944, moved downward, according to the figures released by the Edison Electric Institute. Electric energy distributed by the light and power industry during the week amounted to 4,418,298,000 kw.-hr., as compared with 4,451,076,000 kw.-hr. during the preceding week, which ended on August 19. Figures for the week represented an increase of 2.2 percent over the 4,322,195,000 kw.-hr. distributed during the corresponding week a year ago. The output for the similar week in 1942 was only 3,639,961,000 kw.-hr.

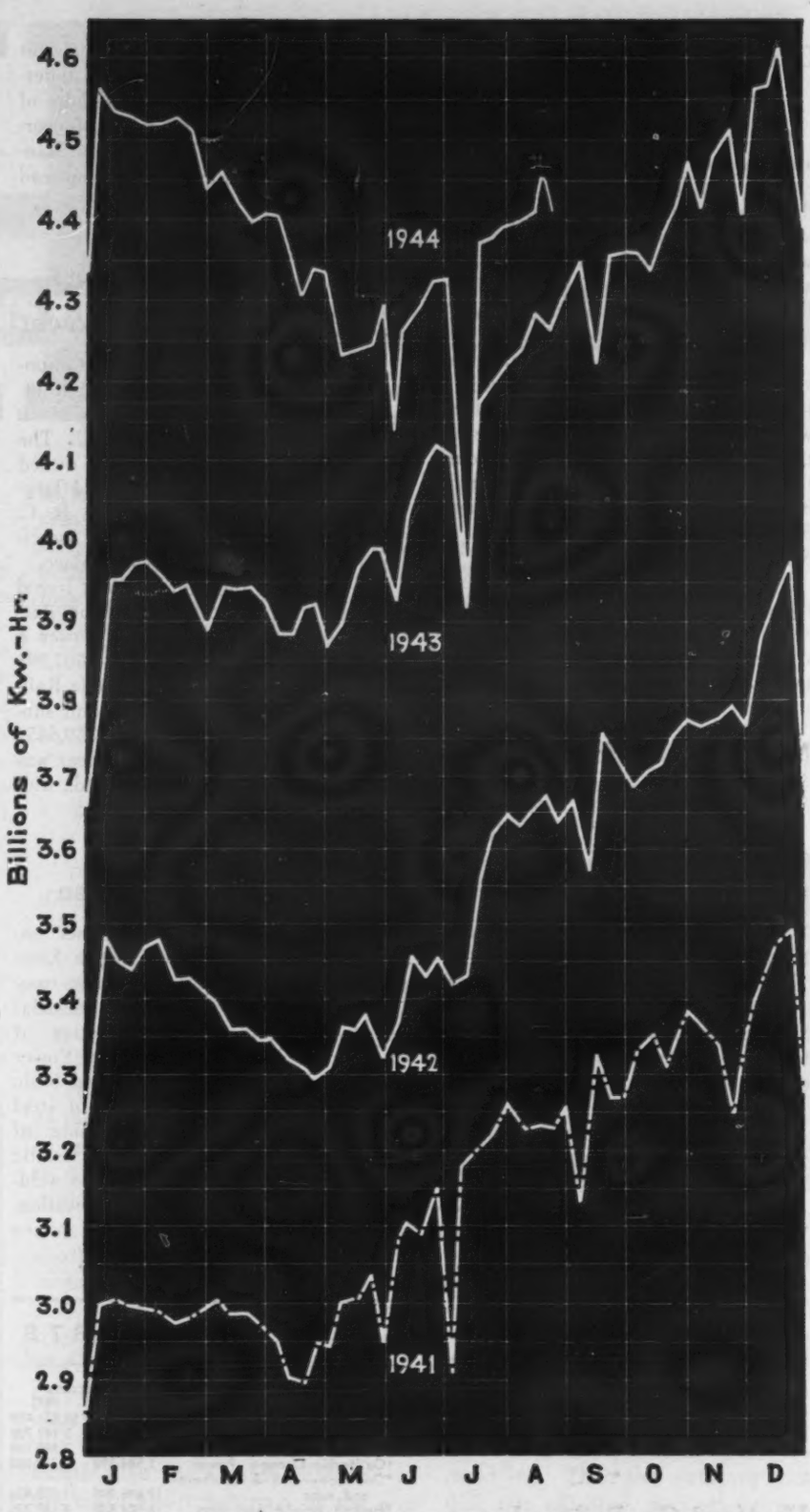
Again five of the seven major geographic regions of the country reported increases over the corresponding week in 1943, the Pacific States, as usual, leading with an increase of 10.5 percent. The gain of 5.1 percent reported for the Central Industrial group for the week ended August 19 as compared with the similar week of 1943 was cut to a gain of only 1.6 for the week ended August 26. The decrease reported by the Mid-Atlantic states increased to 5.2 percent from 1.5 percent.

Weekly Output Millions Kw.-Hr.

1944		1943		1942	
Aug. 26	4,418	Aug. 28	4,322	Aug. 29	3,640
Aug. 19	4,451	Aug. 21	4,265	Aug. 22	3,674
Aug. 12	4,415	Aug. 14	4,288	Aug. 15	3,655
Aug. 5	4,399	Aug. 7	4,241	Aug. 8	3,637
July 29	4,391	July 31	4,227	Aug. 1	3,649
July 22	4,381	July 24	4,196	July 25	3,656
July 15	4,377	July 17	4,184	July 18	3,566
July 8	3,941	July 10	3,919	July 11	3,429
July 1	4,327	July 3	4,111	July 4	3,421
June 24	4,325	June 26	4,120	June 27	3,457
June 17	4,287	June 19	4,098	June 20	3,434
June 10	4,265	June 12	4,040	June 13	3,464

Percent Change from Previous Year

	Week Ending		
	Aug. 26	Aug. 19	Aug. 12
New England	+ 1.4	+ 3.5	+ 2.0
Mid Atlantic	— 5.2	— 1.5	— 4.4
Central Industrial	+ 1.6	+ 5.1	+ 3.1
West Central	+ 2.3	+ 5.2	+ 3.0
Southern States	+ 7.1	+ 7.1	+ 6.5
Rocky Mountain	— 2.6	— 3.9	— 6.0
Pacific Coast	+10.5	+11.9	+13.3
Total United States	+ 2.2	+ 4.4	+ 3.0



Company Loses License for Not Using Water Site

Claiming that the only reason why the Southern Ohio Public Service Co. applied for a license for a water power project on the Muskingum River near Zanesville, Ohio, was to preserve its water rights at the site, the Federal Power Commission has denied the application and has ordered the company to remove all of its buildings and machinery.

The company received its first license in 1925 for a period of approximately five years and has had annual renewals since; operation of the hydro plant was discontinued in 1934.

Wants to Tax City Hydro

The Board of Control (city council) of Toronto, Canada, will apply to the Ontario legislature for permission to tax the Toronto Hydro-Electric system "the same as a private enterprise." In addition a reduction in rates is to be asked.

Canton Closes Own Plant to Buy from Miss. Power

Canton, Miss., which owned and operated its own electric power plant, will close it and buy all of its power from the Mississippi Power & Light Co. The contract between the city and company was recently signed after the board of aldermen and the Canton Utilities Board had agreed unanimously to make the change.

With the growth of Canton in recent years, the municipal plant could no longer handle the load. When faced with the problem of enlarging the station, the city made a study and found that the power could be bought more cheaply from the business-managed company than it could be produced locally. The contract followed.

The Canton plant will not be dismantled but will be kept as a standby station and the city will have entire charge of the distribution and sale of power.

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Next Step of Ross Dam Now Scheduled for June

The second step of Ross Dam, the $10,000,000 project of the Seattle Department of Lighting on the Skagit River, will not be completed until June 1, 1945 instead of by September 15, 1944 as originally scheduled.

Seattle Board of Public Works granted the contracting firm of General-Shea-Morrison an extension when the firm reported that the work was hampered by the weather and lack of labor.

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Wishes to Sell Pfd. Stock

A hearing on the petition of the New York Power & Light Corp. to issue 240,000 shares of cumulative preferred stock at $100 a share will be held by the New York Public Service Commission on Sept. 26. The Niagara Hudson Power Corp., the commission said, had joined in the petition for consent to acquire and hold 55,200 shares of the proposed stock issue.

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Hartford Co. Betters Lines

Construction has been nearly completed of improved facilities for supplying Manchester and Glastonbury, Conn., from the South Meadow station of the Hartford Electric Light Co. The line voltage will be raised from 11 to 22 kv., and modifications in the route effected in the East Hartford district. At Rentschler Field, operated by the United Aircraft Corp., a branch circuit serving Glastonbury is carried underground for 4,000 feet; the remainder of the branch is about 2.5 miles of overhead construction. The line to Manchester is eight miles long of overhead construction.

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West Kootenay Top Maker of British Columbia Power

Power production in British Columbia is now being led by the West Kootenay Power & Light Co., Ltd., which has its headquarters at Trail, B. C. The East Kootenay Power Co., Ltd., owned by affiliated interests is the third largest producer of power, and the B. C. Electric Railway Co., with its associated companies, takes second place.

According to the annual report issued by the Public Utilities Commission, during 1943 the West Kootenay Power & Light Co. Ltd. generated 1,640,507,895 kw.-hr. British Columbia Electric Railway Co., Ltd., and associated and subsidiary companies generated 759,645,589 kw.-hr. Third largest producer was the East Kootenay Power Co., Ltd., with an output of 119,931,424 kw.-hr.

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Take Electronics Course

Fifty-five electrical maintenance engineers, members of the Electric Association of Kansas City, recently completed a 13-week course in industrial electronics under the instruction of Grover C. Meyer, Kansas City Power & Light Co. The course covered basic theory of electronics' treating of steel by induction heating, processing of plastics and plywood by electrostatic heat, control circuit of resistance welders, television and voice communication, supervisory and load control of power transmission circuits.

UTILITY REPORTS

	Net Income 1944	1943
*Alabama Power	$4,212,375	$4,871,432
*Connecticut Light & Power	3,742,742	3,749,708
*Consumers Power	7,490,497	7,980,139
†California-Oregon Power	1,384,898	1,203,080
*Commonwealth & Southern and subs.	11,695,845	13,073,426
*Detroit Edison and subs.	8,503,580	8,669,735
†Duquesne Light	10,432,448	11,004,455
†El Paso Electric (Texas)	574,999	535,411
*Georgia Power	5,265,436	6,366,626
†Gulf States Utilities	2,457,933	1,898,335
*Houston Lighting & Power	2,918,397	3,251,996
*Ohio Edison	2,975,697	3,378,606
†Savannah Electric & Power	255,953	244,630
*Tampa Electric	1,207,606	1,196,578
*Utah Power & Light and subs.	2,178,466	2,126,970
†Virginia Electric & Power and sub.	4,738,317	4,339,159

*Twelve months ended July 31.
†Twelve months ended June 30.

$70,000,000 Suit Decided in Favor of Pacific Gas Co.

A taxpayer's suit involving $70,000,000 was decided in favor of the Pacific Gas & Electric Co. in San Francisco recently, following action brought in connection with a Hetch Hetchy contract for purchase of power from San Francisco's Moccasin creek plant.

Filed four years ago by a woman who never appeared in court, the suit was argued on demurrers and dismissed without trial by Superior Judge C. J. Goodell.

The P. G. & E. was charged with failure to return to the city about $70,000,000 of an alleged $100,000,000 received from sale of the power over a period of 15 years.

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255,000 Meters a Quarter Given Approval by WPB

WPB's Requirements Committee has approved material allotments for the manufacture of 255,000 watt-hour meters per quarter starting with the fourth quarter this year, and final approval of the increased program was to have been granted this week by the Radio and Radar Division, which handles watt-hour meters.

The new program represents an increase of 125,000 meters per quarter, or a virtual doubling of the existing program. It is not anticipated that the full increase will be realized during the forthcoming quarter, but as many as 210,000 meters may be turned out in this period. This would be an increase of 80,000 over present production schedules.

•

1,700 Vancouver Homes Are Waiting to Be Wired

Residential construction in the Vancouver area has been so great that the Electrical Service League of British Columbia reported that on July 1, there were 1,700 houses waiting to be wired. The league issued 222 red seal certificates in the first six months of the year, and 156 other residences were wired in accordance with red seal requirements except for range installations.

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Indiana Raises Tax Base

Indiana will assess its business-managed public utilities (heat, power, water, gas) $227,869,476 as a basis for 1945 tax payments. For 1944, the total valuation was $222,577,855. The Rural Electrification Membership Corporation has been assessed $1,350,302 in comparison with $1,206,664 for 1944.

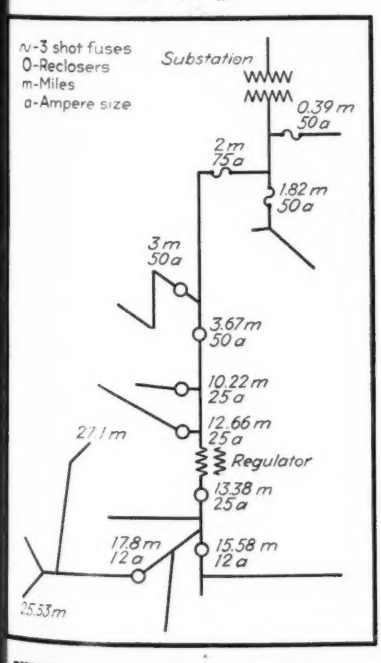
HOW

DESIGN · CONSTRUCT · OPERATE · MAINTAIN

Fuses and Reclosers on Rural Lines

Since the advent of thermal trip circuit reclosers for rural lines, it has become pretty much the general practice to put these devices at locations near to the supply substation and to install multiple-shot fuses, which cost less, farther out on the line. The idea seems to be that the higher-cost equipment should be closer in where the load is greatest. But that does not jibe with considerations of operating economy which include such items as labor time, gasoline and tires.

At the farther points on the line where for coordination of protection smaller fuses and lower settings of reclosers must be used, service outages caused by lightning are naturally more frequent than closer in. This being the case, then the automatic device which will reset itself after a series of temporary faults is to be preferred for a distant point over a fuse that, being blown, must be replaced by a man who had to travel a round trip of 50 or 60 miles, perhaps, to do that one small job. So reasoned the engineers of the Appalachian Electric Power Co. with the result as shown in the accompanying typical rural line protection scheme.



FUSES close in, reclosers farther out on a rural line

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How to Improvise a Phase-Sequencer

By A. R. CONSTANT
Polyphase Meter Tester
New England Power Co., Tewksbury, Mass.

To construct a phase sequence indicator three potential coils from type RDC relays were used. Arranged in a triangle with space in the center for a watthour meter shaft the coils were fastened to a piece of ⅛-in. steel plate cut in the shape of a four-inch equilateral triangle. (Fig. 1).

The method of fastening the coils to the plate was as follows: Three old bolts were turned down on the lathe to a size less than the inside diameter of the coils. These were used as cores and were cut at least ⅛-in. or more shorter than the coil. Each end of the cores was drilled and tapped for a 10-32 bolt. A hole was drilled in the iron plate to take this bolt. This fastened the core to the plate. To hold the coil to the plate a switchboard wire clip, with the screw hole in the center, was cut so that it was slightly less in length than the outside diameter of the coil. The offset part of the clip was placed downward toward the core and bolted to it.

The rotating element of this machine is a watthour meter shaft with its pivot and two disks. The lower disk acts as the rotor of the motor and the upper disk is for indicating purposes. The lower bearing for the shaft was made by drilling a hole in

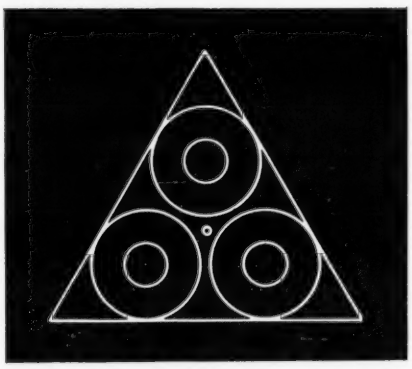

FIG. 1—Stator of phase-sequence indicator has three relay coils arranged on a 4-inch triangular plate

the plate in the space between the coils slightly larger than the pivot point and approximately ⅛-in. deep. The top part of this hole was countersunk. This allows the pivot to slip back into the hole in case the shaft came out. Then the watthour meter disk was adjusted, with set-screw yp, to just clear the coils (Fig. 3). For the top bearing a hole slightly larger than the meter shaft was drilled in a four-inch equilateral triangle of ⅛-in. steel plate. This plate is held in place just above the disk by spacers, made exactly as the cores were. The collar of the lower disk is upward so that as the device is turned upside down

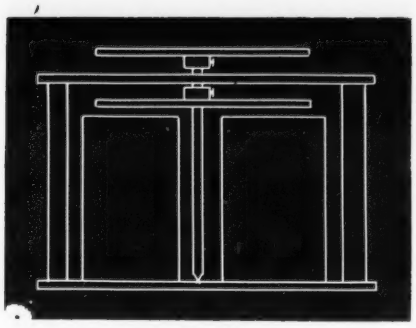

FIG. 2—Cores of turned down bolts hold cores to base plate

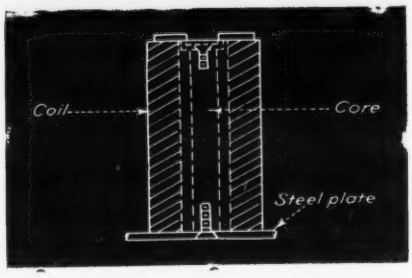

FIG. 3—Watthour meter shaft and disk provided the rotor; a second disk on the outside acts as the indicator of direction of rotation and phase sequence

the shaft won't come out of the lower bearing. Another disk was fastened just above the top plate for indicating purposes.

For service on both 110 and 220 volts the coils were connected in wye and three leads brought out. Very satisfactory results were obtained on 110 volts.

To finish the job the indicator was incased in a wooden box with a small glass opening in the top to allow a person to note the direction of rotation of the disk.

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Wooden Anchors Used For Submarine Cable

When submarine cable was laid across Seneca Lake to supply power to the Naval Training Station at Sampson, N. Y., a method for holding the cable in place was necessitated. This method utilized creosoted wooden anchors installed in earth cuts at the shore lines (Fig. 1).

The cable installation (ELECTRICAL WORLD, October 16, 1943, page 66) consists of four 1/0 single-conductor, 33 kv., lead-sheathed, armored cables, each approximately 1600 ft. long and laid 8 to 10 ft. center to center on the bed of the lake. At both shore lines the cables were placed in three timber anchors spaced 5 ft. apart and then the cut was back-filled.

The six anchors have a clamp fit on the armored cable which is 2.070-in. overall diameter. For construction details of the anchors see the accompanying outline. Material for all the anchors consists of twelve 7-ft. lengths of 6x12-in. creosoted timber, sixty $\frac{3}{4}$-in.x14-in. long galvanized steel carriage bolts and nuts, and sixty 2x$1\frac{3}{16}$-in. galvanized steel washers.

On-shore part of each cable after passing through the last anchor

FIG. 1—Creosoted timber anchor for four submarine cables

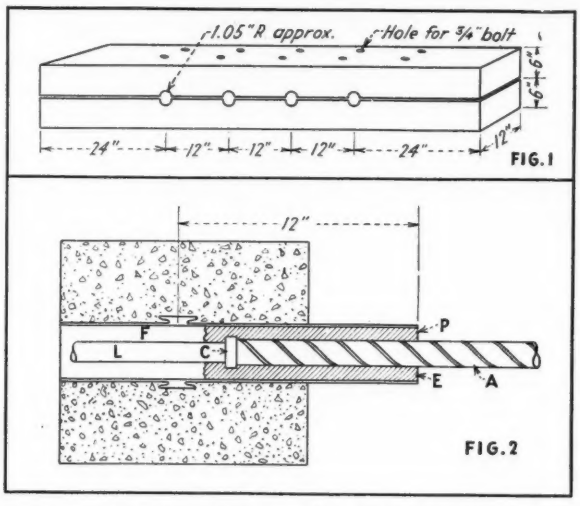


FIG. 2.—(Top) Assembly of timber anchor. (Bottom) Detail of armor termination: A—armored cable; C—armor wire clamp; F—3-in. fiber conduit; E—end of fiber conduit; L—lead cable; P—Dux Seal packing

was stripped of its armor (Fig. 2) Fiber ducts were then threaded ov the lead cables separately and concret encasements poured around them. concrete wall with cable ducts e cased in it was built where the cabl ends within fiber ducts and whe they turn upward at right angles fro their usual almost horizontal positio

•

Radiophone Bridges 30-Mile Telephone Ga

When a freak snowstorm, in ear summer, broke the telephone and te graph lines between Colby and Selde Kansas, the Rock Island (RR) Lin restored and maintained communic tions over the 30-mile gap using po able two-way FM radio-telepho units, one of which is shown in t accompanying illustration.

One transmitting and receiving u was set up at each end of the gap, t

ONE OF TWO emergency FM radio-telephones used to restore and maintain telephone and telegraph communications over storm-made gap in metallic communication circuits.

antenna rigged on an undamaged po and the telephone circuit connected t the unit. Thus the message was broa cast over the gap by the transmitter one unit and picked up by the receiv of the unit at the other end and then was relayed over the telephone syste Two frequencies were employed s that normal telephone communic tions were maintained 24 hours p day for the days required to resto the services of the original lin between the two points.

The radio-telephone units used we designed and manufactured in th plants of the Galvin Manufacturi Corp., Chicago.

Motor Starter Cuts Peak Current

A starter has been developed which in the second position cuts the starting current of a squirrel cage induction motor from the five to six times full load value with normal starter to one and one half full load value with the modified version. By its use the highly efficient squirrel-cage motor with its high power factor and robust construction can be employed where hitherto slip-ring motors or squirrel cage motors with rotors specially designed to give low starting currents had to be used, stated G. A. Wauchope of Gwynes Pumps, Ltd., in a recent issue of the Journal of the (British) Institution of Electrical Engineers.

Four Starting Steps

Illustration depicts the wiring diagram of the four starting steps, the current taken from the line, and the current in the windings. It will be seen that the sequence is as follows:

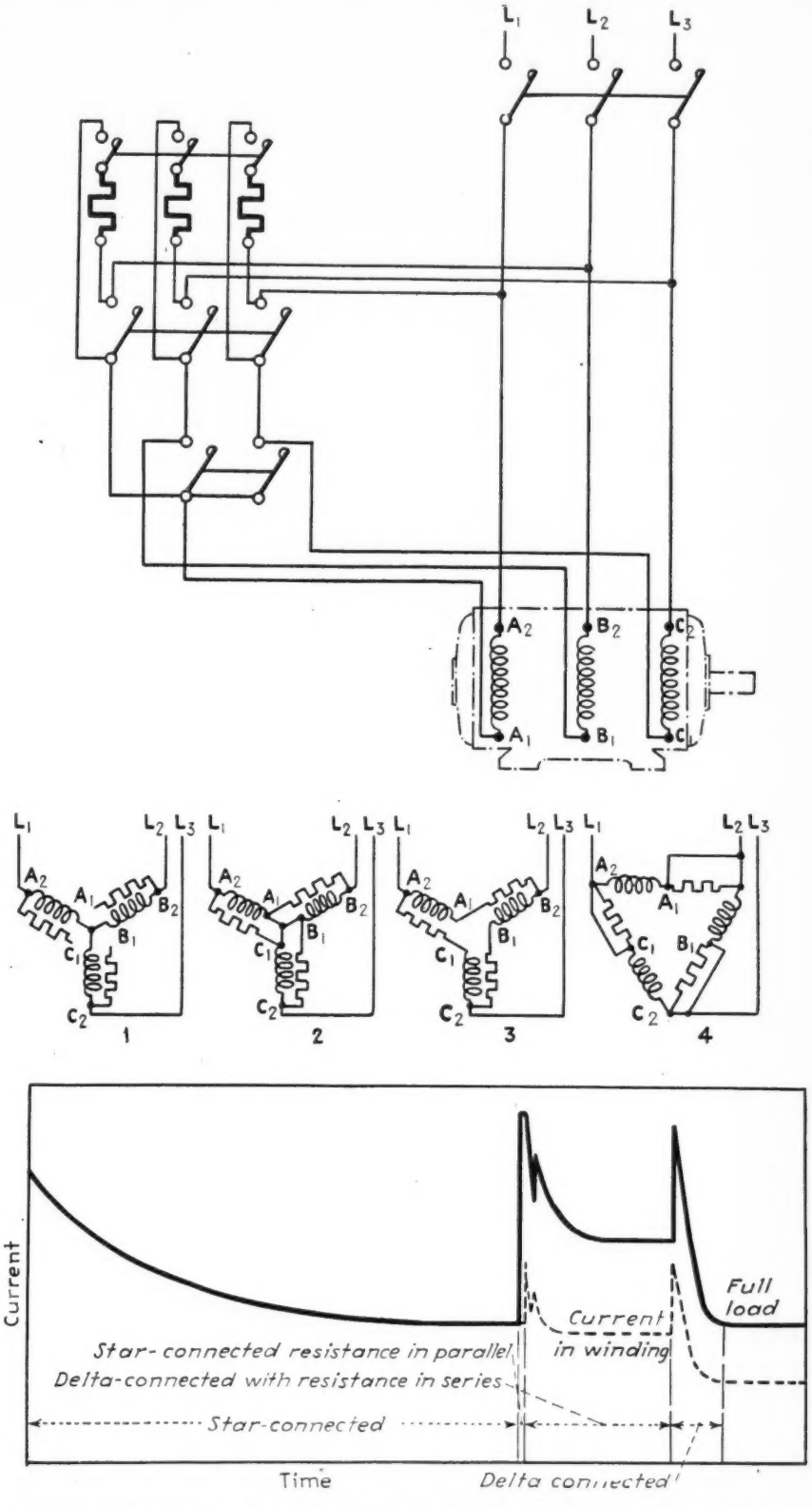
Step 1—The motor is connected in star in the ordinary manner and the machine permitted to run until a steady speed has been reached.

Step 2—A resistor is connected in parallel with each of the motor windings. The current from the line is increased by the amount passed by these resistors but the current in the windings remains unaltered. The duration of this step can be as short as mechanically possible as there is no change in the running conditions of the motor during this period.

Step 3—The star point is now opened in such a manner that the motor windings are in delta but have a resistance in series with each phase. This results in an increased voltage across the windings. The dip in the current curve is due to an alteration in the voltage phase-angle when the connections are changed from star to delta. It only occurs for a fraction of a second and does not appreciably affect the torque. This reduction in current is finite and is not a transient. Acceleration then takes place to a higher steady speed with corresponding decrease in current.

Step 4—The three resistors are short-circuited so that the motor windings are now connected in delta. The voltage on the windings is increased to full line value, the current rises, and further acceleration takes place with decreasing current until the machine attains its final steady speed.

Results of tests on a 15 hp. motor with 5, 6.25, and 7.5, ohms per phase respectively demonstrated that with a high resistance the second peak is reduced at the expense of the third peak but with a low resistance the second peak is higher than the third.



WIRING DIAGRAM of modified starter applicable to squirrel cage induction motors. Also given are winding and resistance connections during the four starting steps

Transformer Bank Rests on T-Frame

Adoption of a suggestion by a line foreman is saving space and material in the pole installation of transformer banks for larger three-phase service from the distribution system of the Knoxville (Tenn.) Electric Power Board. Usual practice is to erect a two-pole platform on which the transformers are set. Here, however, the transformers are hung on one pole in standard cross-arm suspension. Additional support for the transformer weight is supplied by a T-structure set close and bolted to the pole on which the transformers rest and which consists of a pole stub with a 4-in. by 6-in. timber, or larger as may be necessary, across the top. The upper structure and lead training are exactly the same as in single-pole suspension of smaller transformers.

Ordinarily this construction is not used for banks consisting of transformers larger than 37½ kva. But in instances when, in these war times, material, manpower and time were short, transformers as large as 75 kva., 2,300 volts and 50 kva., 7.9 kv. have been installed in this fashion.

• • •

Heat-Time-Relationship Controls Electric Furnace

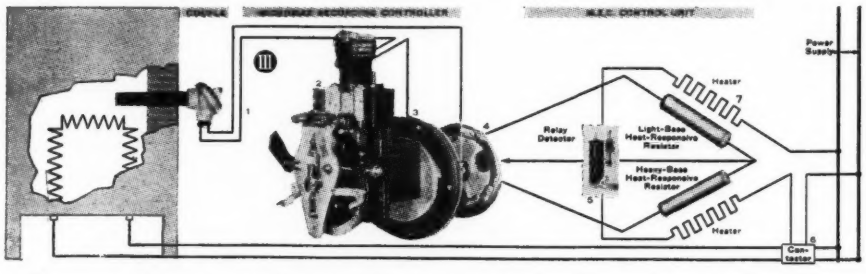
To bring to electrically-heated furnaces, ovens, and similar units a regulation of temperature comparable to that obtainable with fuel-fired furnaces, a new type of control having a dial-adjusted heat-time relationship has been developed by Leeds and Northrup Co., called Micromax Electric Control, Duration - Adjusting Type.

By means of an "on-off" contacting system, it feeds to the heating unit the amount of current needed to keep temperature to the required control point or program. Input is either "full on" or "full off." Regulation is obtained by controlling automatically the time during which current is "on" and "off."

This new system provides full proportional time action, as compared with the more familiar full proportional positioning action. It provides automatic droop-correction and it can be equipped with overshoot control, valuable when the furnace or other unit is coming up to temperature.

To apply the balance principle both to measurement and to contactor regulation, this device uses a potentiometer or a bridge measuring circuit, but with a control circuit whose basic elements are shown in the diagram.

(1). When temperature leaves the control point, the resulting change in thermocouple or Rayotube e.m.f. (or Thermohm resistance) unbalances the measuring circuit. (2) Galvanometer deflects and engages the motor-driven Micromax mechanism, which turns (3) the measuring slidewire to restore measuring-circuit balance and at the same time (4) turns mechanically the control slidewire, on the same shaft,



Micromax electric control circuit showing heat-responsive resistors, heaters, contactor and relay in the control unit and the recording controller

to unbalance the control circuit. Just as measuring-circuit unbalance deflected the galvanometer, so control-circuit unbalance acts on a relay-detector (5). This effect on the relay-detector modifies the on-off operation of a contactor in the furnace heater circuit (6). The durations of current input to the furnace heaters as well as to small heaters (7) in the control circuit are increased or decreased through a series of interactions described as follows:

A. Proportioning heat input to the extent of temperature departure because of the action of one of the two heaters in the circuit. It is connected as long as furnace current is on, synchronizing with the furnace heaters. By acting on one of the two heat-responsive resistors (the light-base one) this representative of the furnace heaters balances or unbalances the control circuit, independent of slidewire position. Even with the temperature at control points momentary heating or cooling of this heater (depending on whether contactor is closed or open) unbalances the circuit . . . causing the contactor to reverse its position, until slight unbalance occurs in opposite direction. This alternating action feeds to the furnace just the current needed to hold temperature at control point.

When Temperature Falls

If furnace temperature leaves the control point—falls for instance—the resulting slidewire movement introduces its unbalancing effect to call for more heat. Contactor now stays closed until there's a correspondingly larger increase in resistance of the variable arm. The little heater must stay on longer. So will the furnace heaters. Thus on-time durations lengthen as temperature falls; shorten as temperature rises. With return to control point, oscillation is again as first described. But because relationship of temperature to rate of heat-input is fixed for a given load, a sustained load change will prevent temperature from returning to control point. There will be droop.

B. Proportioning heat-input to the time that temperature has remained off the control point, the control allows furnace heating current to modify not just one arm of the bridge, but two. The second heat-responsive variable resistor modifies the second arm of the bridge more slowly to increase the extent of unbalance progressively as temperature remains longer off the control point. This not only affects the rapidity with which temperature is turned back, but assures action which continues until, regardless of load changes, duration of on-time in relation to off-time is so adjusted automatically that temperature must return to the control point.

The heating-time-relationship between the two variable resistors is adjustable by dial through a wide range of rates of automatic droop-correction.

Here's a Fuse Cutout That WILL SAVE YOU MONEY

wherever transformer secondaries are not banked

ENCLOSED, NONINDICATING
Over 1,500,000 in Service

1. Wet-process porcelain housing, glazed inside and out, has ample mechanical and insulation strength.

2. Barriers, on both housing and Textolite door, interleave to prevent conducting arc gases from bridging the contacts when high currents are interrupted.

3. Silver-plated, heavy-duty, self-aligning contacts of the high-pressure-blade type assure permanently low contact resistance, low operating temperature, and long life—even under heavy loading or unfavorable atmospheric conditions.

4. When the cutout door is opened, the fuseholder is removed from both contacts, and is safely isolated from the contacts by a generous clearance.

5. The fuseholder, which has silver-plated contact blocks, can be removed or inserted without tools. Even in the dark, it cannot be placed in the cutout door incorrectly. (The same is true of the disconnecting blade, which can be used in place of the fuseholder.)

6. The hanger clamps to the crossarm, and provides choices of vertical or down-tilted, and straight-out or swiveled positions of the cutout.

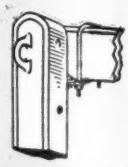
Stocked in 50- and 100-ampere, 5000-volt and 7500/12,500-volt Gr. Y ratings

Reliable in any weather - - works without moving parts

Lowest in price of all wet-process, porcelain-enclosed types, these nonindicating cutouts afford a considerable saving on transformer installations not having banked secondaries, where the location of a blown fuse is indicated by a phone call from the consumer whose service is interrupted.

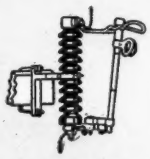
Since these cutouts were introduced, in 1928, all contacts, fuseholders, and other parts have been interchangeable. Such standardization reduces your stocks and maintenance costs. For complete information, ask our local office for Catalog GEA-2489C. Or write General Electric Company, Schenectady 5, N. Y.

Remember these other G-E devices for complete, economical overcurrent protection


Enclosed indicating and drop-out fuse cutout

Two-element reclosing door for cutout at left

Disconnecting-blade door for cutout at left


Open-type fuse cutout with drop-out fuse holder

Flip-open fuse cutout

Indicating, secondary fuse cutout

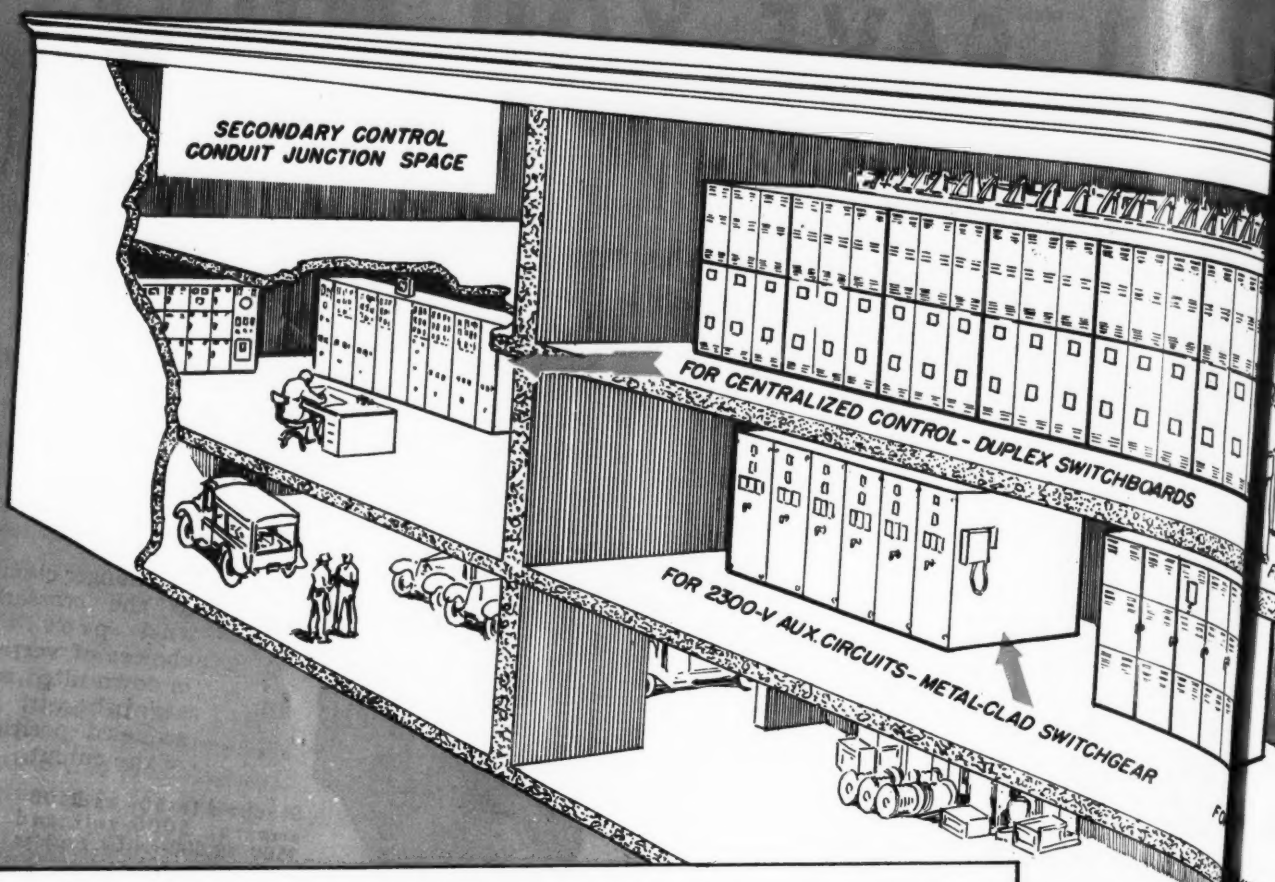
Universal, cable-type primary fuse links

GENERAL ELECTRIC

406217-5264

BUY WAR BONDS

LOOK FORWARD TO THIS


SECONDARY CONTROL
CONDUIT JUNCTION SPACE
FOR CENTRALIZED CONTROL - DUPLEX SWITCHBOARDS
FOR 2300-V AUX. CIRCUITS - METAL-CLAD SWITCHGEAR

HOW ONE COMPANY MADE REAL SAVINGS IN PLANNING, INSTALLATION, and OPERATION — using *standard* units

THE sketch shows a recent installation of complete primary and secondary switchgear equipments. The entire installation, including duplex control board, metal-enclosed reactors, and bus runs, was planned as *one co-ordinated job.*

When another generator was required, instead of adding to its concrete-cubicle switchgear, this utility took advantage of modern equipment. This layout of metal-enclosed switchgear saved space. Bus runs were kept as short as possible.

Expensive, tedious construction-detail planning was avoided by utilizing standard repetitively built units. The installed cost was thousands of dollars lower than it would have been for on-the-job assembly or custom-tailored structures. Then, too, the cost was accurately predictable.

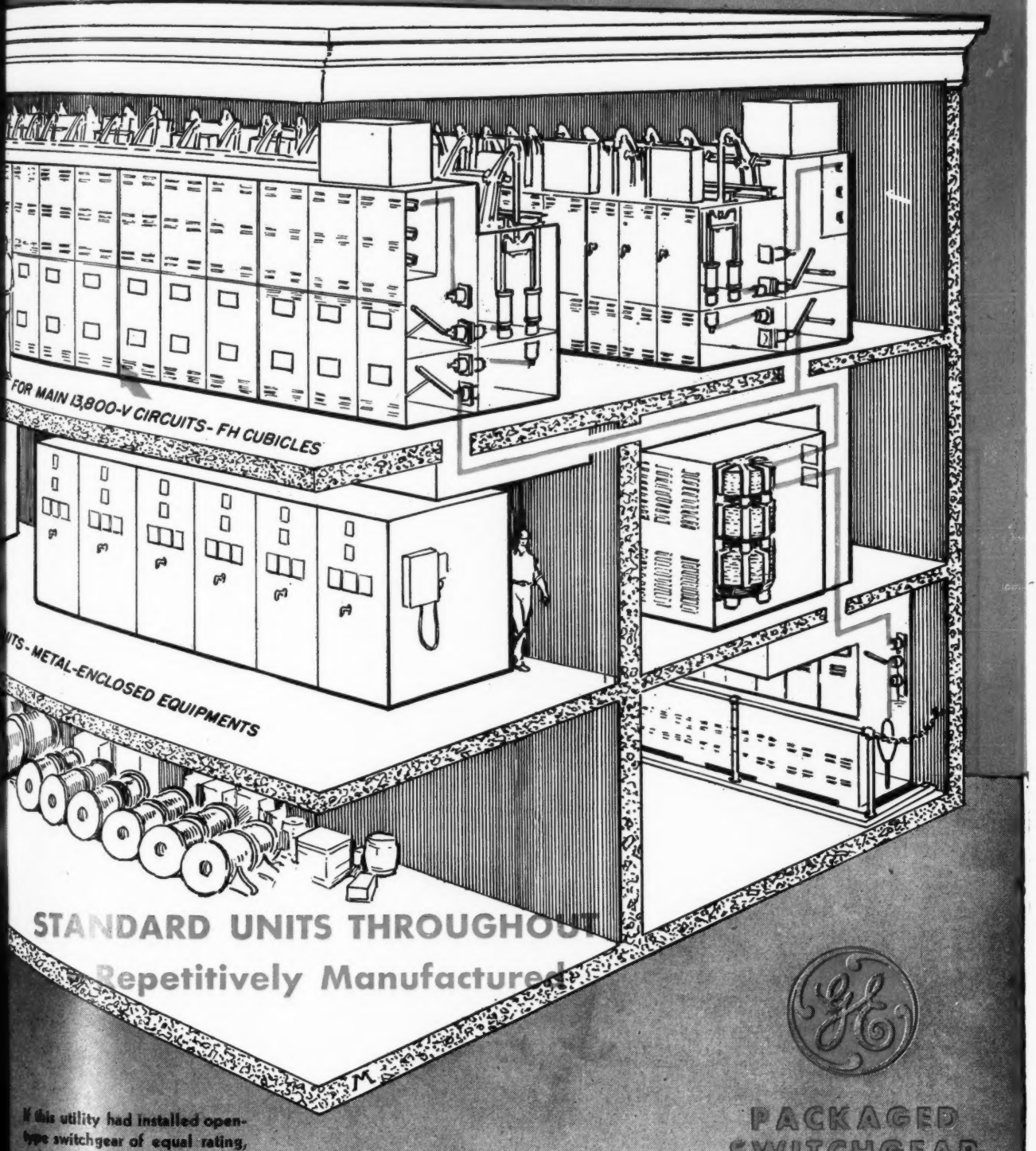
Note the short bus runs, and the central, air-conditioned control room which serves both the new and the old installations. Equipment like this represents the best modern practice of metal enclosure for safety to personnel and service.

The nearest G-E office will give you further information. *General Electric Company, Schenectady 5, N. Y.*

GENERAL ELECTRIC

855-15-7300

TYPE OF SWITCHGEAR



STANDARD UNITS THROUGHOUT
Repetitively Manufactured

If this utility had installed open-type switchgear of equal rating, at least twice as much floor space would have been required.

PACKAGED SWITCHGEAR

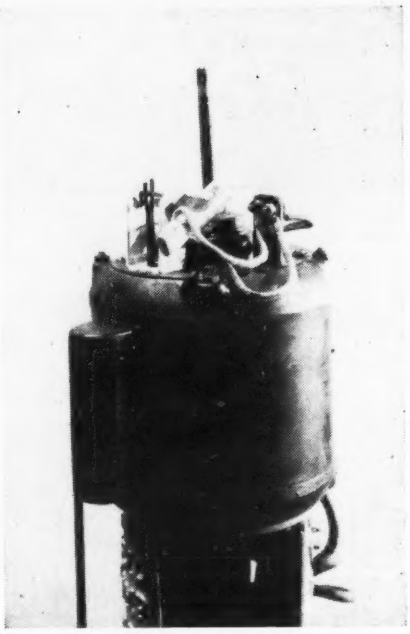
Buy all the BONDS you can—AND KEEP ALL YOU BUY

Sump-Pump Motor Made Explosion-Proof

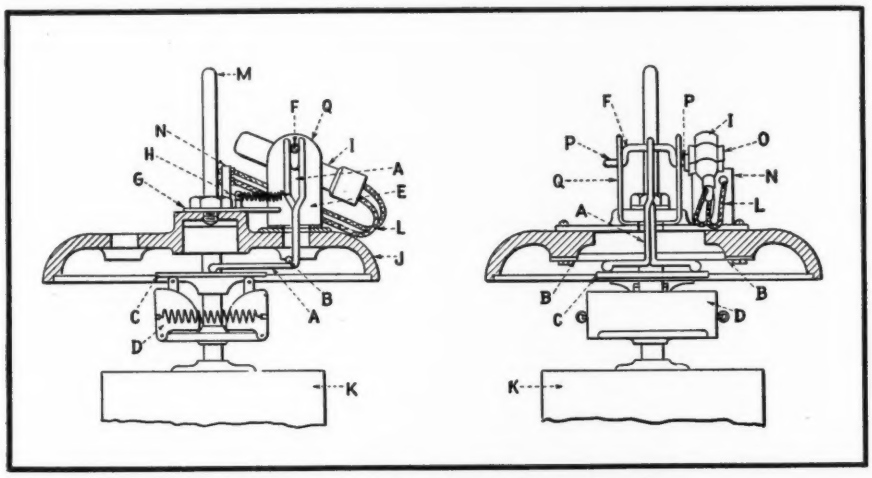
By WILLIAM P. SMITH
Appliance Service Superintendent
Philadelphia Electric Co.
Morton, Pa.

In the Delaware Division of Philadelphia Electric Co. there are forty-three manholes on a three phase 66,000 volt cable line equipped with single-phase sump pumps. Some of these manholes are subject to gas accumulation from foreign sources which might explode if a spark occurs from the starting contact of the motor. An explosion-proof device was built and installed on each of the motors. The pumps have been operating with the device for about one year and have proven satisfactory in all respects.

Functioning of the device hinges on a right angle lever arm "A" pivoted at "B" and "B" of the top motor bell.



GOVERNOR-PLATE movement tilts mercury switch which controls the motor circuit



BELL-CRANK device is adjusted to break contact in 3 seconds or less

The lever is shaped so that the horizontal leg rides on the bakelite governor plate "C" which is a normal part of the motor governor assembly "D." The vertical leg is shaped to form a Y, in which rides a crank "F." The crank bearings are located at "P" and "P" in a vertical U shaped stand "Q" which is fastened to the top motor bell. One end of the crank "F" is fastened to a fuse clip "O" which holds a standard glass sealed mercury tube "I," which replaces the starting contacts.

Spring "H" is fastened between the vertical leg of lever "A" and the stop plate "G." The spring "H" is in tension, which makes lever "A" move towards the left when the rotor of the motor attains speed and the governor plate "C" drops.

Stop plate "G" stops the movement of arm "A" at a fixed point and prevents the horizontal leg of lever "A" from cutting ridges in the bakelite governor plate "C."

As the vertical leg of lever "A" moves to the left, the crank "F" follows. This tilts the mercury tube "I" and breaks its contact.

The device is adjusted to break contact in three seconds or less, in order to protect both the starting condenser and the starting winding of the motor. When pumping is satisfied the device works in reverse and the mercury tube is returned to its starting position.

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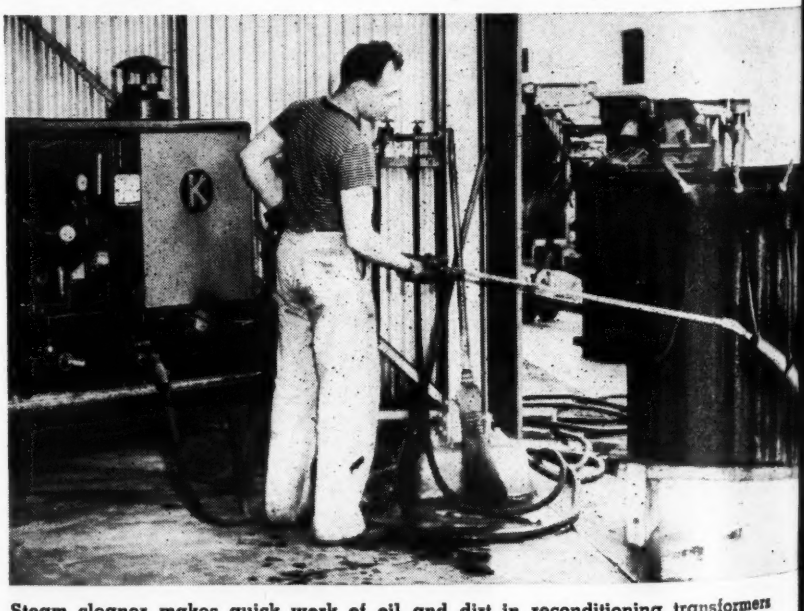
Steam Cleaning Cuts Transformer Repair Cost

By M. A. BROWN
Southern California Edison Co.,
Alhambra, Calif.

Steam cleaning of transformers going through its Alhambra shops for reconditioning is saving Southern California Edison Co. considerable time and expense as well as doing a better and more thorough job. A Kerrick steam generator, similar to those used for cleaning automobiles and greasy parts, is used for this purpose.

Before introduction of the steam cleaning process it took several hours to scrub and scrape sludged and caked oil and oil-soaked dirt from inside and out of transformer cases. With steam, the job is quickly, easily and effectively done in a few minutes time. The Kerrick cleaner shown was purchased especially for the purpose.



Steam cleaner makes quick work of oil and dirt in reconditioning transformers

Question: What's the accuracy classification of this instrument transformer?

Type JW-1 current transformer, 5000 volts, for high-accuracy metering

Answer:

ASA Burden	B-0.1	B-0.2	B-0.5	B-2
ASA Accuracy Class	0.3	0.3	0.3	0.3

This means that with standard ASA burdens, the ratio correction factor and the transformer correction factor will be within the limits of the ASA accuracy class 0.3.

NEMA Burden	X	Y	Z
NEMA Accuracy Class	¼	¼	¼

This means that with standard NEMA burdens, the ratio error and the phase-angle error will be within the limits of the NEMA ¼ accuracy class.

How Accuracy Classification Helps You

IN the selection and application of instrument transformers, a thorough knowledge of the new ASA system of accuracy classification can help a great deal.

For example, different applications often require different transformer characteristics. A transformer that is satisfactory for metering purposes (highest accuracy up to 100 per cent of its current rating) may not be satisfactory for relaying purposes where the *overcurrent* characteristics (currents as much as 20 times normal) must be considered.

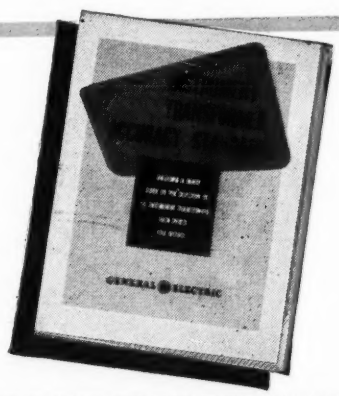
The new ASA accuracy standards have made possible the most precise method of selecting instrument transformers yet devised. All G-E instrument transformers are classified in accordance with these standards.

This enables you to select the transformer with the most suitable characteristics for the job to be done. *General Electric Company, Schenectady 5, N. Y.*

BUY ALL THE BONDS YOU CAN—*KEEP ALL THE BONDS YOU BUY*

GENERAL ELECTRIC

604-13-6400

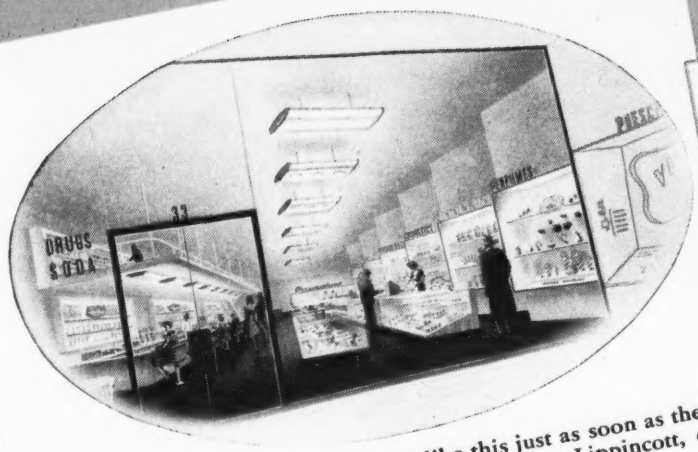


FOR A BETTER UNDERSTANDING OF ACCURACY CLASSIFICATION

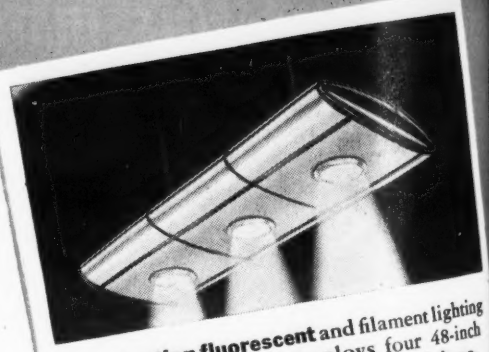
This publication explains the ASA accuracy standards for current and potential transformers and shows how they differ from the NEMA standards. Also, you will find this booklet a handy guide to the selection of G-E instrument transformers. Ask for your copy today. Address the G-E office nearest you.

HEADQUARTERS FOR ELECTRICAL MEASUREMENT

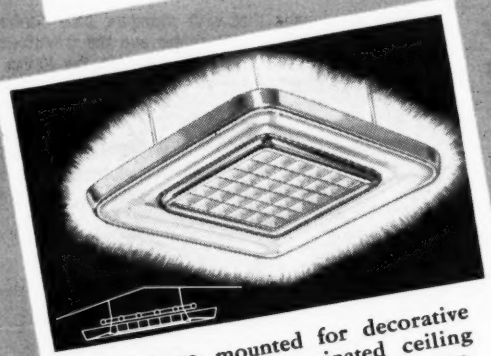
From G-E's Design Program—IDEAS OF



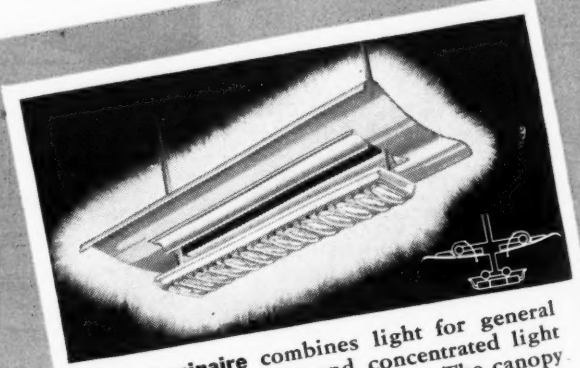
Drug stores want modern lighting like this just as soon as they can get it. Plan and fixture are by J. Gordon Lippincott, of Dohner & Lippincott, New York.



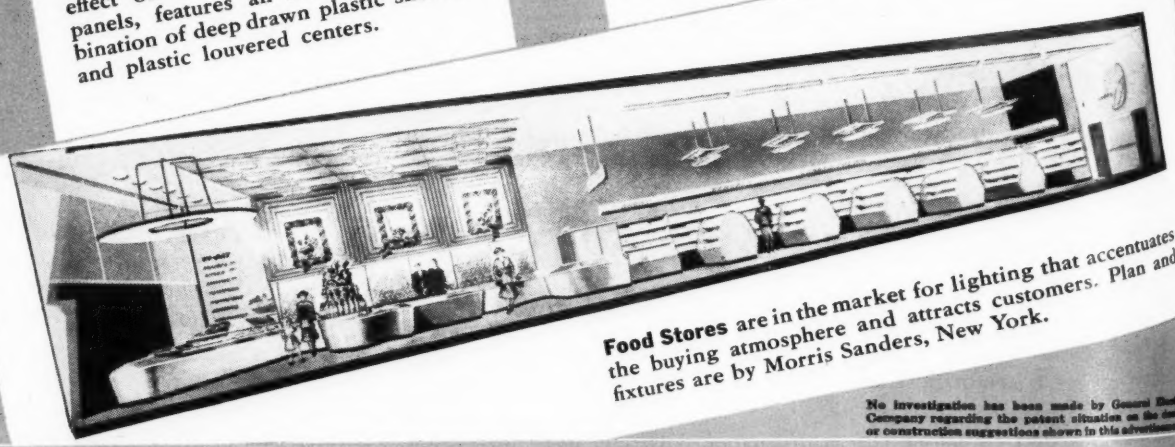
Combination fluorescent and filament lighting fixture shown above employs four 48-inch fluorescent lamps plus concentrated down-lighting on displayed merchandise.



This fixture, mounted for decorative effect on coffered laminated ceiling panels, features an interesting combination of deep drawn plastic shields and plastic louvered centers.



This luminaire combines light for general ceiling illumination and concentrated light that highlights display surfaces. The canopy is low-pressure molded plastic; lower part is translucent plastic.



Food Stores are in the market for lighting that accentuates the buying atmosphere and attracts customers. Plan and fixtures are by Morris Sanders, New York.

No investigation has been made by General Electric Company regarding the patent situation on the design or construction suggestions shown in this advertisement.

GENERAL ELECTRIC

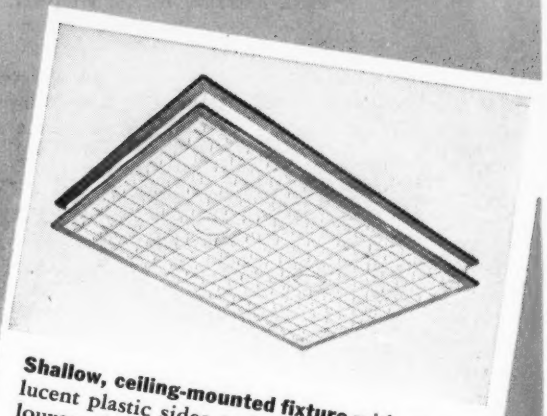
Hear the General Electric radio programs: "The G-E All-Girl Orchestra", Sunday 10 p. m. EWT, NBC; "The World Today" news, every weekday 6:45 p. m. EWT, CBS.

LEADING DESIGNERS ON POSTWAR FIXTURES

TODAY, almost 1,500,000 stores in this country need relighting. To help you bring them the full benefits of modern lighting, General Electric is commissioning leading architects and designers to work out ideas for new and more attractive lighting fixtures. Seventeen of these men are now at work on this program. Several of their ideas are illustrated here. More of them will be ready soon.

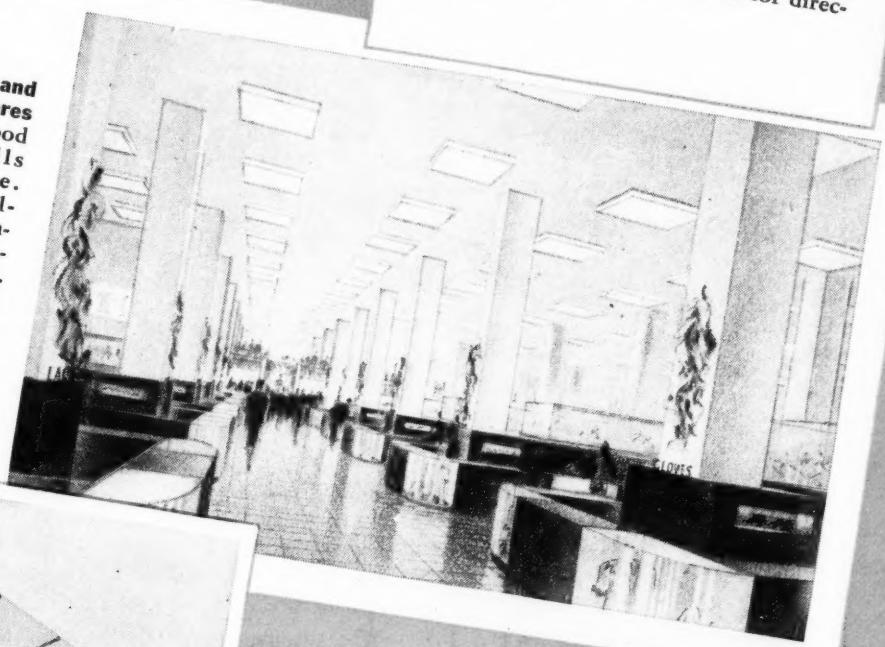
From these original designs, fixture manufacturers are already working on new lighting tools that will help you get a full share of postwar lighting profits.

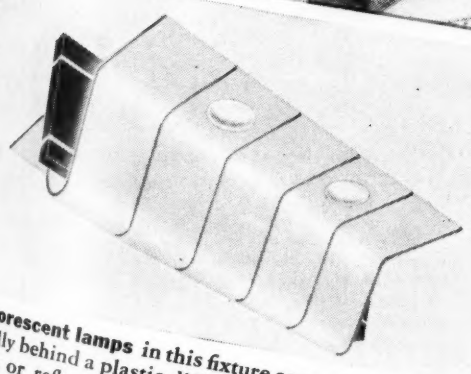
ILLUSTRATED BOOKLET *describing G-E's design program is now available. Write for Booklet Y-467, General Electric, Nela Park, Cleveland 12, Ohio.*



Shallow, ceiling-mounted fixture with translucent plastic sides and "egg-crate" plastic louvers for light diffusion. Two spotlight housings in center are adjustable for directional lighting.

Department and Specialty stores know that good lighting sells merchandise. Thousands already have complete modernization programs. Plan and fixtures shown here are by Graham, Anderson, Probst & White, Chicago.





Fluorescent lamps in this fixture are arranged vertically behind a plastic diffusing shield. Adjustable spot or reflector lamps may be readily directed on special merchandise displays.

"TO MAKE G-E LAMPS STAY BRIGHTER LONGER"
The Constant Aim of G-E LAMP RESEARCH

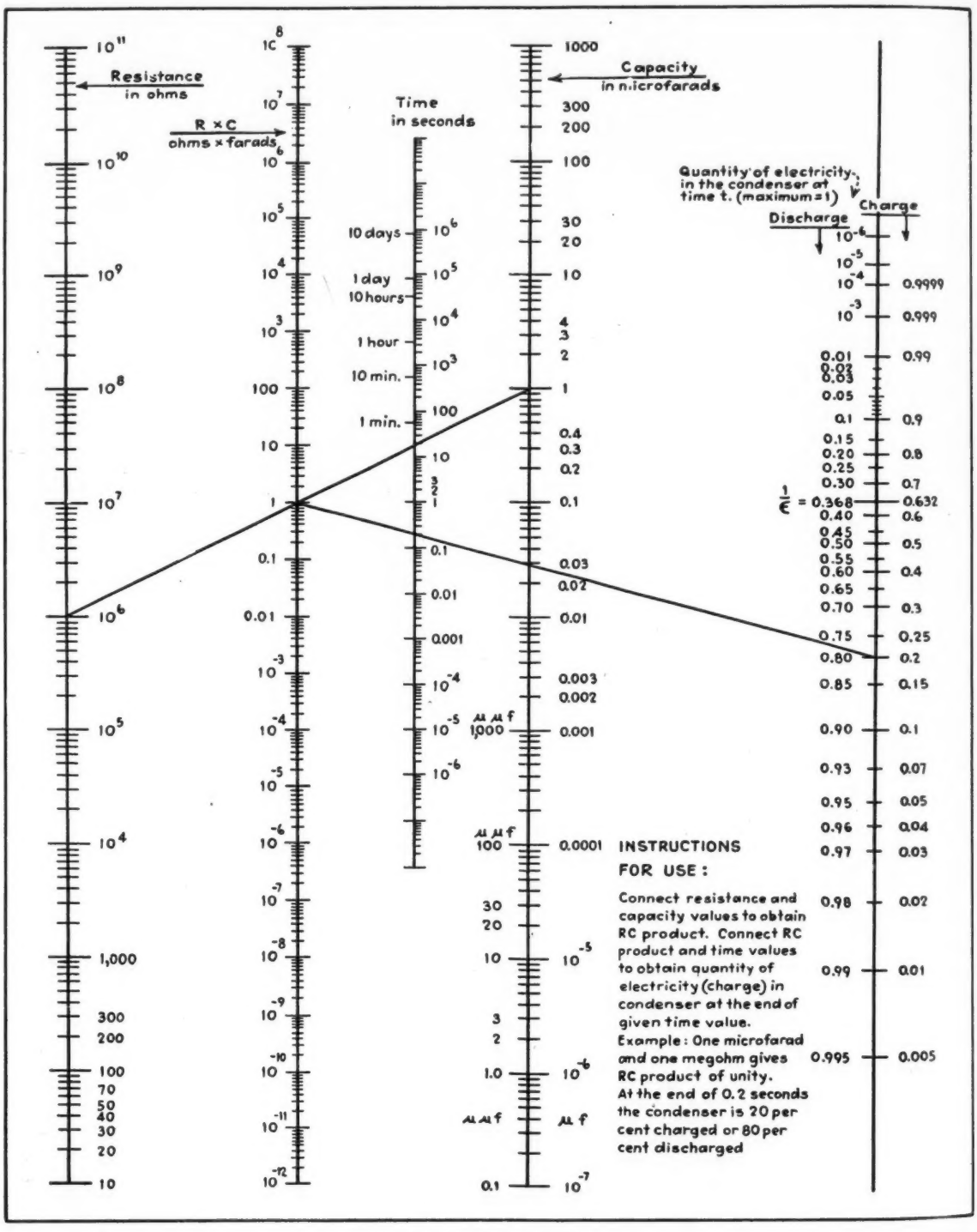
G-E MAZDA LAMPS

KEEP BUYING WAR BONDS — KEEP THE WAR BONDS YOU BUY

NOMOGRAM CALCULATES CONDENSER DISCHARGE TIME*

By J. BARTON HOAG, Professor, U.S.C.G. U. S. Coast Guard Academy, New London, Conn

A considerable variety of time delay circuits and relays now in use are resigned around the inherent time delay involved in charging or discharging a condenser through a series resistance. This nomogram computes the charge or discharge of a condenser through a series resistor in terms of the RC product and time.


Resistance in ohms
R × C ohms × farads
Time in seconds
Capacity in microfarads
Quantity of electricity in the condenser at time t. (maximum=1)
Charge
Discharge
10 days
1 day
10 hours
1 hour
10 min.
1 min.
μμf
μf
INSTRUCTIONS FOR USE:
Connect resistance and capacity values to obtain RC product. Connect RC product and time values to obtain quantity of electricity (charge) in condenser at the end of given time value.
Example: One microfarad and one megohm gives RC product of unity. At the end of 0.2 seconds the condenser is 20 per cent charged or 80 per cent discharged

* Reprinted from Electronics

ANYTHING THAT WILL...

BURN

BURNS BETTER WITH

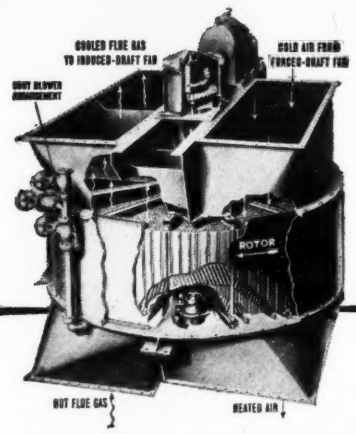
Preheat Engineering

When availability, rather than quality, determines your choice of fuel, high-efficiency preheat helps keep your output high. In the present emergency, Ljungstrom-equipped plants have found it possible to use coals having considerably higher ash and moisture contents than that for which the plant was originally intended, and still hold to rated capacity. At oil refineries, a higher percentage of waste products has been successfully burned.

Any fuel will burn better with an adequate supply of high-temperature combustion air. On boiler plants, refinery furnaces, metallurgical furnaces, and many others, Ljungstrom Air Preheaters permit more complete heat recovery in a unit of practical size and weight. Operation is highly flexible to meet changing fuels or operating rates.

ENGINEERING SERVICE

The engineering staff of the Air Preheater Corporation is prepared to assist you in applying standard or special types of Ljungstrom Preheaters to your fuel conservation needs, or to help you and your engineers make better use of low-grade, more abundant fuels.



THE LJUNGSTROM AIR PREHEATER

The heating surface is contained in a compact, slowly rotating cylinder. Soaking up heat from the hot flue gases, it then rotates to a chamber where it liberates the heat into incoming combustion air.

This continuous, regenerative, counterflow principle assures maximum heat transfer with minimum weight and size. Generally, the Ljungstrom weighs less than half as much as tubular or plate preheaters of similar capacity. With the Ljungstrom, it is possible to obtain preheated air up to 1500 deg. F.

THE
AIR PREHEATER
CORPORATION

Executive Offices: 60 East 42nd Street, New York 17, N. Y. • Plant: Wellsville, N. Y.

TYPES AND CHARACTERISTICS OF FIRST-AID FIRE EXTINGUISHERS*

First-aid appliances are designed to cope with fires in their incipiency and are necessary even though the property is equipped with automatic sprinklers or standpipe and hose; the latter should be regarded as second line of defense called into action only if fire is discovered too late or cannot be brought under control with first-aid appliances immediately at hand.

Four general classes of fires, as adopted by National Board of Fire Underwriters for indicating the proper application of first-aid appliances, and the basic methods of extinguishing them, are:

Class A—involving wood, paper, textiles, rubbish, which produce embers and require quenching and cooling

Class B—involving flammable liquids such as oils, paints, cleaning fluids, for which "blanketing" or smothering effect is necessary

Class C—involving electrical equipment, for which a non-conducting extinguishing agent is essential, and requiring principally blanketing effect. Burning substances may be a combination of those listed as Classes A and B

Class D—involving passenger automobiles, buses, trucks, boats, and other automotive equipment. Such fires may involve Classes A, B and C in any combination.

Two Basic Methods of Extinguishing Fires—One method is by cooling the burning substance below its ignition temperature, that is, quenching it with water or similar coolant. Other method is by excluding oxygen from the surrounding area, to extent that combustion can no longer be supported, that is, by smothering, as with inert gas or foam bubbles. There may be combinations of these two principles, and in addition a chemical action tending to inhibit oxidation.

* Adapted from "Handbook of Fire-Safety Practices for Public Utility Property," Ebasco Services Incorporated, New York, N. Y.

Type	Plain Water (a)		Soda-Acid	Loaded Stream	Foam	Carbon Tetrachloride		Carbon Dioxide		Dry Compound
	Pump Tank	Cartridge				Pump	Stored Pressure	Small	Large	
Size	5-gal.	2½-gal.	2½-gal.	2½-gal.	2½-gal.	1-qt.	1-gal.	7½-lb.	15-lb.	15-lb.
Weight, lb	65	35	35	45	35	7	30	35	45	40
Method of operation	Pumped by hand	Inverted	Inverted	Inverted	Inverted	Pumped by hand	Valve opened	Valve opened	Valve opened	Valve opened
Effective range, ft	30 to 40	30 to 40	30 to 40	30 to 40	30 to 40	20	20 to 30	6	8	6 to 16
Time to empty	1.5 to 2 min.	1 min.	1 to 1.5 min.	1 min.	1 to 1.5 min.	45 sec.	1 min.	20 to 30 sec.	35 to 45 sec.	20 to 25 sec.
Underwriters' classification	A-1	A-1	A-1	A-1, B-1	A-1, B-1	B-2, C-1	B-2, C-1	B-2, C-1	B-1, C-1	B-1, C-1
Principal extinghishing agent	Water		Water	Water and special chemical	Foam bubbles containing inert gas	Inert gas, after liquid vaporized by heat		Inert gas		Dry powder releasing inert gas
Effect produced	Cooling		Cooling	Cooling, oxidation inhibiting	Blanketing	Smothering		Smoothering, cooling		Smothering
Conductor of electricity	Yes		Yes	Yes	Yes	No		No		No
Need of freezing protection	Yes		Yes	No	Yes	No		No		No
Materials used										
Main charge	Water	Water	Water	Water	Water	Carbon tetrachloride, containing anti-freeze and lubricant		Liquid carbon dioxide		Bicarbonate of soda, specially treated
Supplementary	None	Gas cartridge	Sodium bicarb 1.5 lb. sulfuric acid 4 oz	Special alkali-metal salt	Aluminum sulfate, sodium bicarbonate, foaming agent	Compressed air (for stored-pressure type)		None		Carbon dioxide cartridge
Maintenance, annual	Partial discharge, then refilling	Water level check, gas cartridge check by weighing	Complete recharge	Complete recharge	Complete recharge	Partial discharge, then refilling		Leakage check by weighing		Gas cartridge check by weighing
Effect on fires										
A — wood, rubbish	Excellent		Excellent	Excellent	Good	Poor		Fair		Fair
B — flammable liquids	Poor		Poor	Fair	Excellent	Fair		Excellent		Excellent
C — electrical	Poor (b)		Poor (b)	Poor (b)	Poor (b)	Good		Excellent		Excellent
D — vehicles	Limited		Poor	Poor	Poor	Good		Excellent		Excellent

Note (a) — These water-type extinguishers suitable also for anti-freeze compound, thus avoiding need for other cold-weather protection.

(b) — These types not recommended for fires in electrical equipment; however, for some kinds of electrical fires, such as in switching equipment, wiring, motors, transformers, the quenching and cooling effect of large quantities of water or solutions containing mostly water is necessary; in these cases, equipment and circuits should be de-energized before using such extinguishers.

Electrical Wiring is Basic!

That's why Anaconda's national advertising drive is important to every electrical utility

ANACONDA's advertising campaign is aimed at creating a sounder basis for your postwar business. It urges postwar planners to allow extra capacity in wiring plans. It puts the spotlight on the big increase in the demand for power and equipment sure to come.

Don't overlook the opportunity to tie in with this special campaign. Plan now to get a maximum share of its benefits. Link your own promotion to your local adequate wiring bureau activities and Anaconda's basic advertising theme: It's always wiser to Wire Ahead! 44262

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THINK AHEAD
Electrically
How many "VICTORY" JOBS will result from
increased use of Electric Energy
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Electrical Wires and Cables of Copper are the Life Lines of our Nation

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25 Broadway, New York 4... Sales Offices in Principal Cities

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A series of sketches shows a surge passing through a length of cable in an open wire line. The data chosen represents a 2,000-ft. section of cable, the length of open wire line on each side being long enough so that no reflections from the far ends need be considered.

The surge is a 0.5 microsecond wave, but the front of the wave is sloped slightly and the peak rounded to make the drawings clearer. This wave is shown in sketch (A) and has a peak value of 500 kv. The small arrows indicate the direction of travel of the front of the wave.

Sketch (B) shows the wave at the time the peak reaches the first cable terminal. Part of the wave enters the cable, but is reduced from 500 kv. to 100 kv. because the surge impedance of the cable is lower than the open wire line. The balance of the wave is reflected as a negative wave. This reflected wave travels back along the open wire line and subtracts from the original wave.

Sketch (C) shows the wave 2 microseconds later. The main wave has passed halfway along the cable and has the same shape as the original wave, but is reduced to one-fifth of its value. The reflected wave has traveled back and in this case results in a negative potential at some points along the line. The drawing shows the resultant voltage at each point, but this may be the resultant of two or more waves traveling in the same or opposite direction. Each of these waves must be followed independently and the voltages at any point combined to obtain the net potential.

Sketch (D) shows the wave when it reaches the second terminal. Here again part of the wave passes through and, in going to a line of higher surge impedance, is increased. Part is reflected, but in this case is positive so it adds to the tail of the original wave.

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After 8 microseconds the reflected wave reaches the first terminal and is again reflected and refracted. The wave is shown at 2 microsecond intervals in sketches (F), (G), (H), and (I) the latter being after 14 microseconds. Each reflection is smaller than the previous one and the ultimate voltage reached depends on the rate of decay of the original wave.

Maximum voltage on the cable is 180 kv. which occurs at the second terminal when the original wave is reflected. The maximum value at the first terminal is 177 kv. which occurs when the first reflection returns to this point and is reflected.

Certain data regarding the voltages is built up in the cable are of interest.

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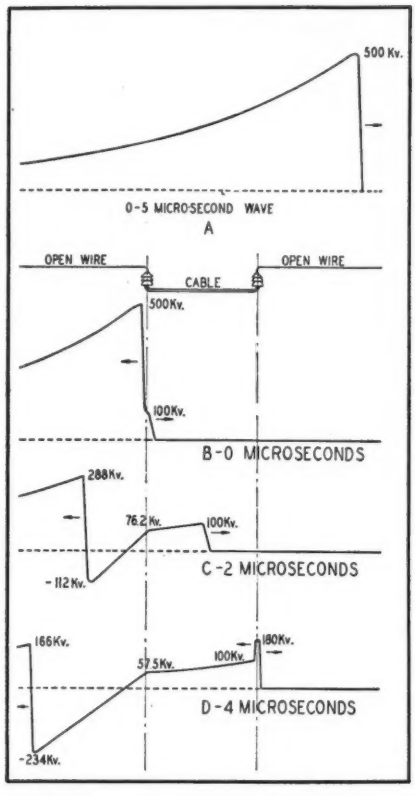

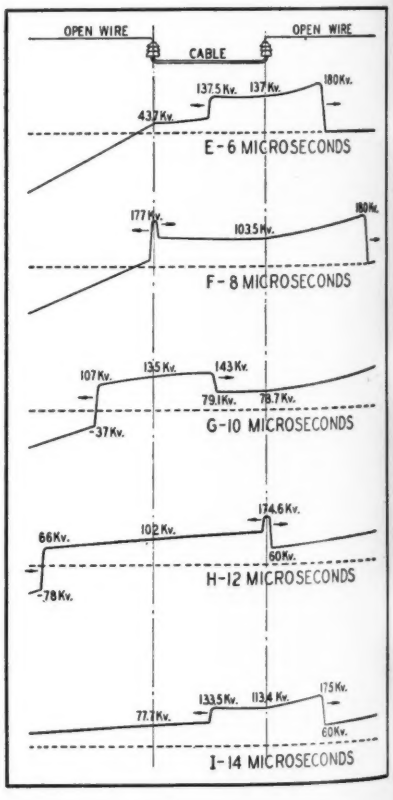

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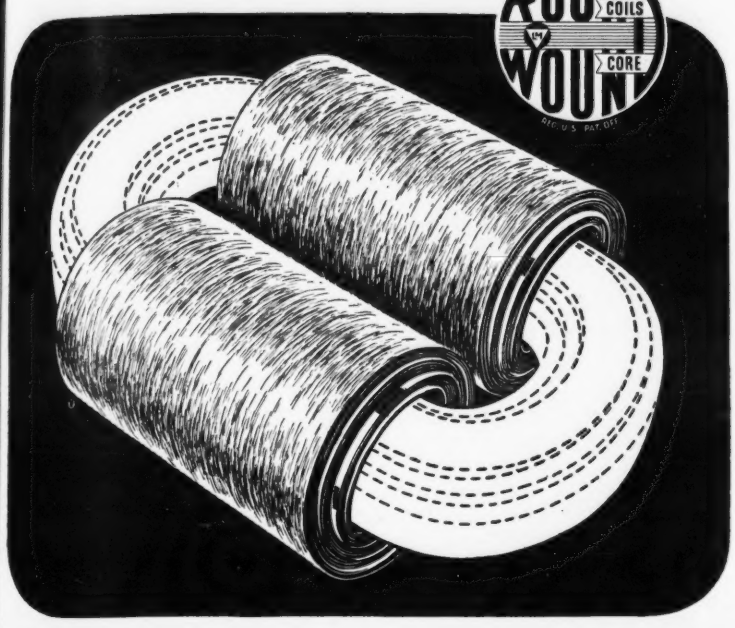

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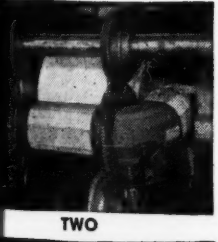

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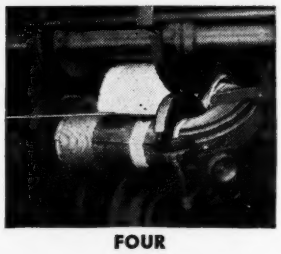

FOUR

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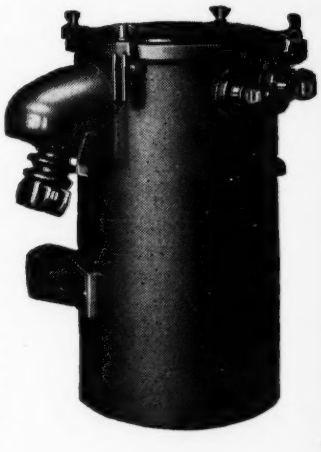

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TRANSFORMERS

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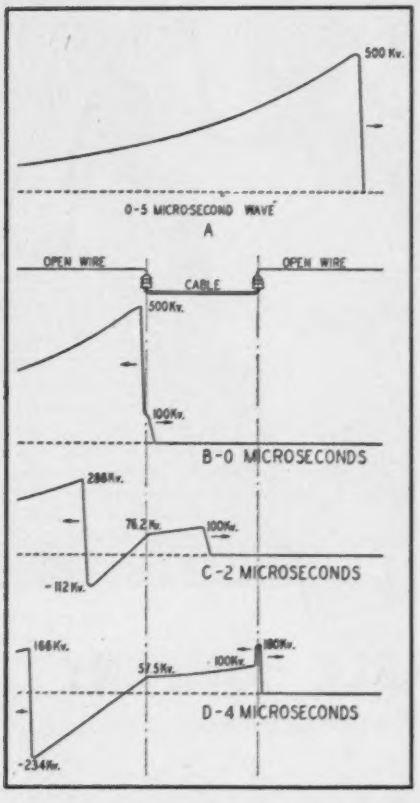

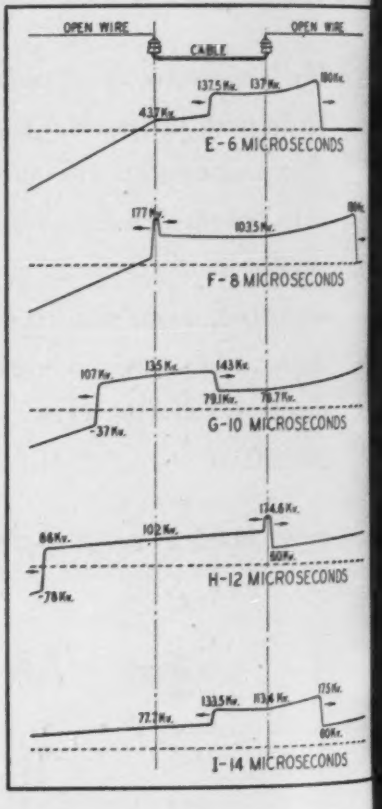

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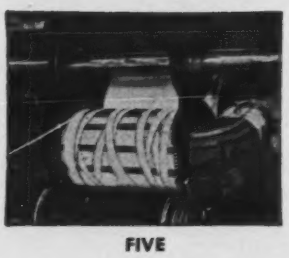

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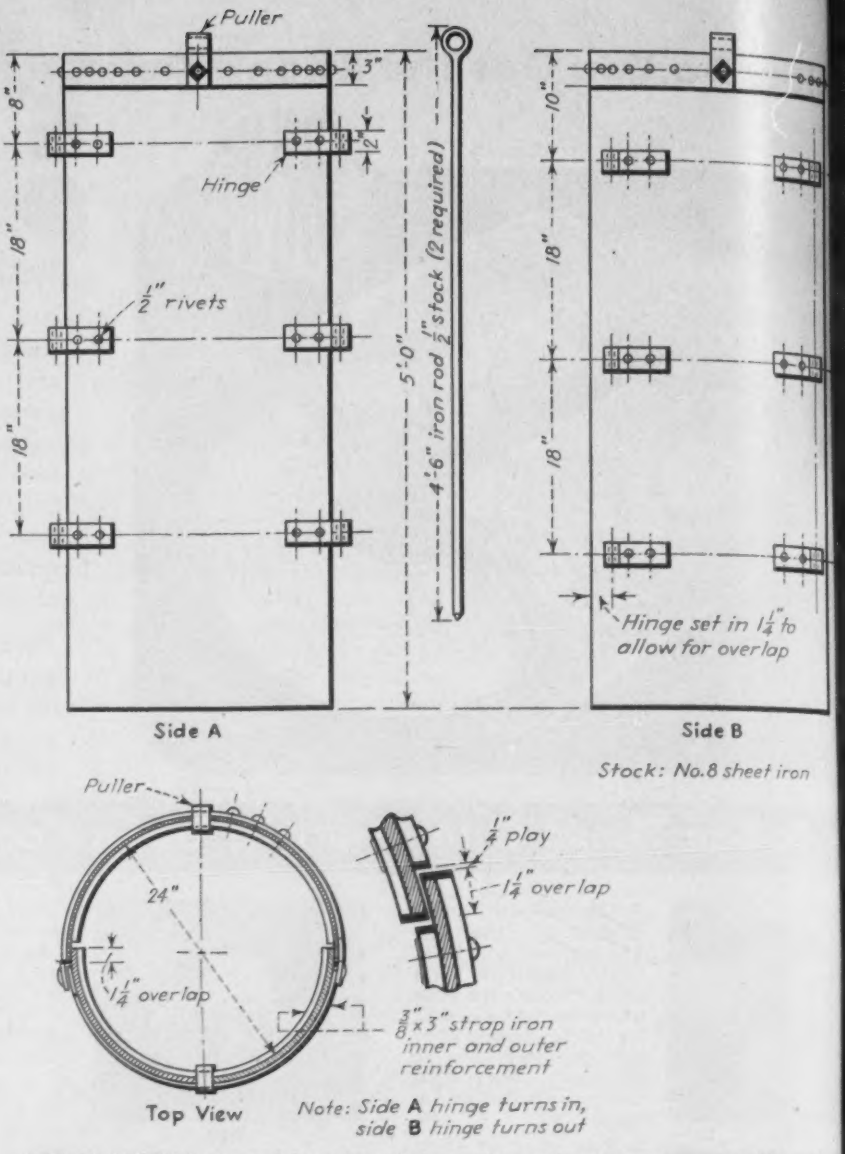
Sand Barrel Helps Set Poles in Swamp

The accompanying drawing shows design details of a "sand barrel" used by Wisconsin Power & Light Co., Madison, to keep the sides of pole holes sunk in quick sand, swampy or sandy soil from sliding in during digging operations.

The "barrel" is a cylinder of No. 8 sheet iron 2 ft. in diameter and 5 ft. high that is divided in halves along its longitudinal dimension. Halves of the barrel are held together by two ½-in. iron pins that engage hinge loops riveted along its sides in a position that allows a 1¼ in. overlap between mating sides of the drum or barrel.

In use the barrel is set into the pole hole, after it has been started. It is then either driven with mauls or "walked" down into the soft soil far enough to allow workmen to dig out the soil within the casing; allowing it to settle gradually as the hole is deepened. When the hole is "down" far enough the pole is set inside the drum and backfilled. The drum is then removed in its two parts by pulling the hinge pins and raising the halves with blocks that engage pulling ears provided for the purpose on the reinforced rim of the drum.

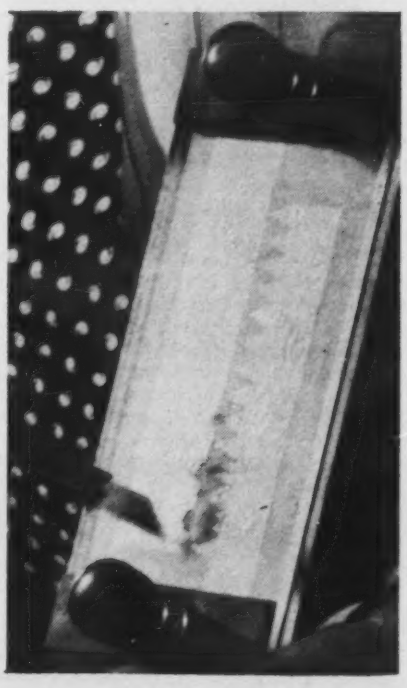


DESIGN DETAILS of sand barrel used for setting poles in swamp or quick sand

Plastic Counter For Lightning Strokes

A development for use in the never-ending campaign to protect power lines from damage by thunderbolts is a counter that "writes" with lightning on a plastic slate. The device enables power company engineers to obtain an accurate record of the lightning strokes that hit their lines, discharging to ground through their protective devices and also down the towers. The counter was invented by Dr. Leo Finzi, a research engineer for the Westinghouse Electric and Manufacturing Co.

Not much larger than a playing card and weighing less than a whole deck, the lightning stroke counter has two strips of metal foil enclosed between two pieces of transparent plastic. One foil strip has a number of teeth cut in its edge. The point of each of these teeth is a few thousandths of an inch from the straight edge of the second strip as shown in the illustration.



SMALL POINTER emphasizing the sawteeth of the lightning stroke counter which develops the black spot

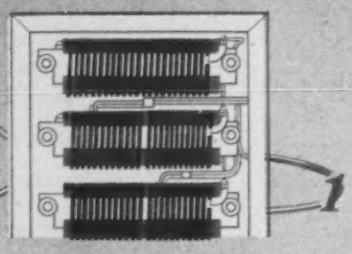
When lightning strikes a power line a voltage drop is produced in the discharge path to ground. The two electrodes of the device are connected to pick up an adequate portion of this voltage causing a spark to jump from the sawtoothed strip to the straight-edged piece of foil. The spark scorches a black spot on the clear plastic and burns away the tip of the tooth, so that the next discharge will choose another path.

The counter has the advantage of giving repetitive records and enables power companies to keep a record of the number of times each lightning arrester along their lines has operated. When placed on towers along unguarded transmission lines the

Another Famous D-H Alloy

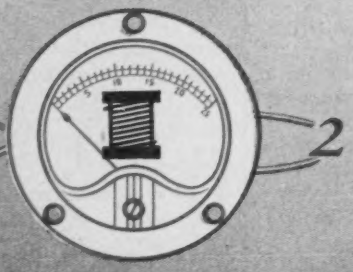
Advance

...does 3 JOBS EFFICIENTLY



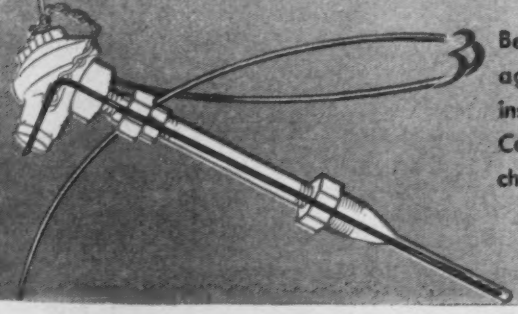
1

High electrical resistance (294 ohms per Circular Mil-foot), great ductility and non-corroding properties make it particularly good for winding heavy duty industrial resistors employed in motor starting and controlling equipment. Both wire and ribbon are used in this application.



2

In finer sizes *negligible* temperature co-efficient of resistance (±.00002) combined with high resistivity makes it the most desired resistance alloy for winding precision resistors of the type used in electric meters and laboratory testing devices.



3

Because Advance* develops high and uniform thermal e m f against Platinum, Copper or Iron, it is used extensively by all instrument manufacturers in the well-known Iron-Advance and Copper-Advance (Constantan) Thermocouples. Small temperature changes are clearly indicated through larger scale deflections.

*Trade Mark Reg. U. S. Pat. Off.

Advance is only one of a large, famous family of versatile Driver-Harris resistance alloys that can be relied upon to make your post-war products more dependable. For important information about improved resistance alloys write for a free copy of Data Book R-42 . . . a complete text on Advance and other D-H alloys.*

D/H

Driver-Harris COMPANY

HARRISON, NEW JERSEY

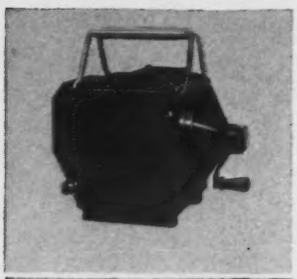
BRANCHES: CHICAGO · DETROIT · CLEVELAND
LOS ANGELES · SAN FRANCISCO · SEATTLE

Special Purpose Alloys Since 1899

with **"MEGGER" INSULATION TESTING INSTRUMENTS**

Today's heavy demand on every type of electrical equipment makes maintenance a matter of vital importance. Regular check tests of the insulation on motors, cables, controls and other electrical apparatus will save priceless time through the detection of incipient failures and the application of corrective measures.

Make sure that your electrician has a "Megger" instrument and that he *takes time to use it.* Minutes with the "Megger" tester can save days of delay. If you are not aware of the protection afforded by the use of "Megger" instruments and their importance in keeping electrical equipment in operation, write for the Pocket Manual of "Megger" Practice, No. 1420-W.



THE NEW U. S.-MADE "MEGGER" INSULATION TESTER—Consists essentially of a direct-reading true ohmmeter of the permanent magnet moving coil type mounted with a d-c hand generator in a plastic molded case. Ranges up to 1000 megohms, with hand generators up to 500 volts. Widely used in hard service. Variable-pressure ("Meg") and constant-pressure ("Super-Meg") types. Bulletin 1735-W.

THE "BRIDGE-MEG" RESISTANCE TESTER—This instrument is a combined "Megger" Insulation Tester and a four-dial, multi-ratio Wheatstone Bridge. Will measure any ohmic resistance from .01 ohm up to 100 or 200 megohms; hand generators rated up to 1000 volts. A complete and compact resistance measuring unit that is ideal for power companies and industrial plants. Catalog 1685-W.

THE MIDGET "MEGGER" TESTER—In many ways the most remarkable "Megger" instrument ever built. Weighs only 3 lbs.—will fit an overcoat pocket or tool kit. Reads up to 50 megohms. Generates 500 volts and is always ready to use anywhere because of the hand crank. Send for Catalog 1690-W.

JAMES G. BIDDLE CO. • **1211-13 ARCH STREET PHILADELPHIA 7, PA.**

counter will disclose the location and number of direct discharges from line to ground, thus giving further interesting data.

•

"The Watt-Hour Meter Modern vs. Old"

The editors have been advised by the author of the above-named article (ELECTRICAL WORLD, *July* 22, 1944) that four changes should be made in the included table, "Watt-Hour Meter Comparison." They are:

"Total" column, line 8, "(b) Total kw.-hr. gain" should be 3,460 instead of 3,450.

"Total" column, line 9, "Gain/Installation/Month (kw.-hr.)" should be 1.7 instead of 1.6.

Col. 6, line 8, "(b) Total kw.-hr. gain" should be 100 instead of 90.

Col. 6, line 12, "Loss/Installation/Month (kw.-hr.) should be 2.1 instead of 1.9.

•

Branch Resistance of "Delta" Network

By H. G. YARRILL

Assistant District Meter Engineer, Hydro-Electric Power Commission of Ontario, Ontario, Canada

A method has been developed for measuring the resistance of each branch of a network without opening the delta. Items required are (1) a source of direct current, (2) a d.c. ammeter, and (3) a d.c. voltmeter of high resistance as compared with the resistance value to be measured. It should be noted that where very high accuracy is required a potentiometer method of measuring voltage may be used.

Test procedure is as follows:

Referring to the diagram, identify the corners of the delta as A, B, C, respectively, and the individual network branches between the corners as Sec. 1, 2 and 3.

(1) Pass a known d.c. current through the network at A and B and measure the voltage across these points. In the example given the current is 1.435 amp. and the voltage = 6.0 volts. Resistance of the network between the corners A and B is therefore 4.167 ohms.

(2) Measure voltage at A and C, across Sec. 3=3.6 volts. Also measure voltage at C and B, across Sec.

SILICONES

Silicone Insulating Varnishes

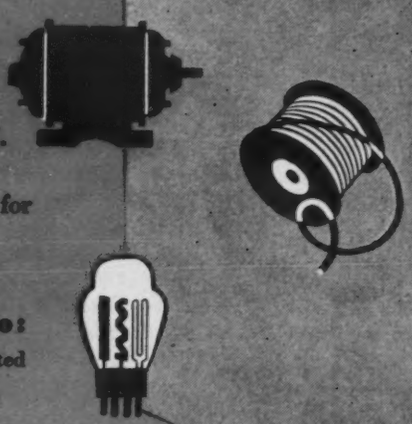
Now Available in Production Quantities

Dow Corning RESINS

Dow Corning Resins—Outstanding high temperature varnishes are specially designed for use with heat stable electrical insulating materials. These products make possible operating temperatures as high as 200°C. They combine heat resistance and moisture-proofness with exceptional retention of electrical properties.

Dow Corning 993—A silicone varnish for Fiberglas served magnet wire, Fiberglas or asbestos cloth, tape and sleeving; impregnating motor stators, transformer coils, and other electrical equipment. Operating temperature, 150°C. to 200°C.

Dow Corning 2052—A silicone varnish for impregnating rotating equipment. Operating temperature, 125°C. to 175°C.



Dow Corning Silicone Products Include:

Fluids—Inert liquids, with viscosity little affected by temperature changes; for operation at sub-zero as well as elevated temperatures.

Greases—For lubrication of valves in high temperature or corrosive chemical services.
Plugcock Grease—For metal valves.
Stopcock Grease—For glass and ceramic valves.

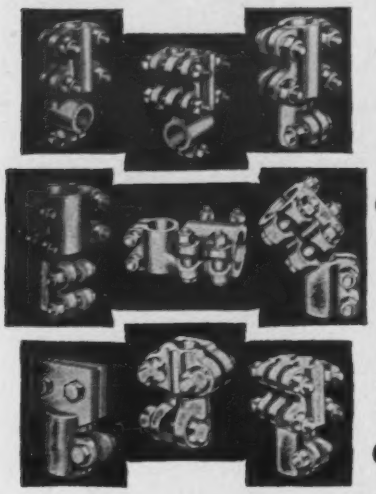
DOW CORNING

DOW CORNING CORPORATION, BOX 592, MIDLAND, MICHIGAN

"You select
EXACTLY
what you need—

—from the COMPLETE line"

Stud Connectors and Solderless Terminal Adapters for distribution and power transformers . . . for connecting to cable, pipe or bus bar . . . in line or at any angle. Connectors with reversible clamping caps take two different ranges of cable sizes. Furnished for any number of conductors. A few of Penn-Union's many types:



Also . . . the most complete line of Service Connectors, Cable Taps, Tees . . . Straight and Parallel Connectors . . . Bus Supports, Spacers . . . Grounding Clamps, Terminal Lugs, etc. etc.

Penn-Union conductor fittings are the first choice of leading utilities, industrials, electrical manufacturers and contractors—because they have found that *"Penn-Union" on a fitting is their best guarantee of Dependability.* Write for Catalog.

PENN-UNION ELECTRIC CORPORATION
ERIE, PA. *Sold by Leading Jobbers*

PENN-UNION
Conductor Fittings

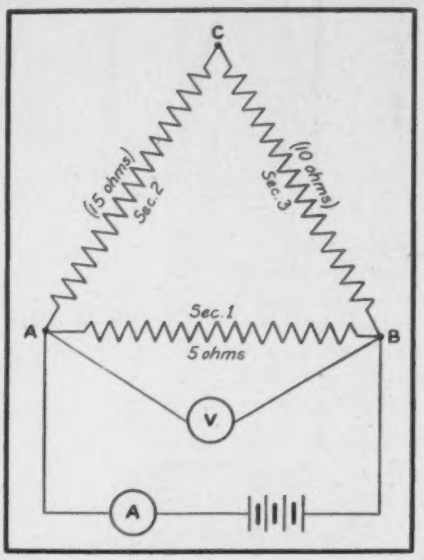
2=2.4 volts. (The current—1.435 amps—should be maintained at unchanging value during these tests.)

(3) Transfer the current leads to corners A and C. (The change in current value from the previous test is not important.)

(4) Measure voltage at C and B, across Sec. 2 = 4 volts. Also measure voltage at A and B, across Sec. 1 = 2 volts.

Solution of Problem—From the above test result, we have obtained the relative proportions of each branch of the network.

By test (2) the ratio of Sec. 3 to Sec. 2 is 3.6 to 2.4 or Sec. 3 is 1.5 times Sec. 2.



CONNECTIONS and designations for measuring resistance of a closed delta network. Resistance values in brackets are the unknown values to be determined by the test and have been used in the example, for the volt and ampere readings that would be obtained by actual test on the delta network

By test (4) the ratio of Sec. 2 to Sec. 1 is 4 to 2 or Sec. 1 is 0.5 times Sec. 2.

Assume some convenient ohmic value, near the value obtained in test (1) which was 4.167 ohms, say, 4 ohms as a reference value for Sec. 2.

Then Sec. 2 = 4 ohms

Sec. 3 = 4 × 1.5 = 6 ohms
Sec. 1 = 4 × 0.5 = 2 ohms

Applying these values to the network as used in test (1) the resistance of the network would be:

$$\frac{2 \times 10}{12} = 1.67 \text{ ohms}$$

Using that value of resistance as a divisor applied to the mesh resistance obtained in test (1) i.e., 4.167 ohms, obtain a constant:

$$\frac{4.167}{1.67} = 2.5$$

Using that constant as a multiplier for the reference values used previously on the three sections, we get:

Sec. 1 = 2 × 2.5 = 5 ohms
Sec. 2 = 4 × 2.5 = 10 ohms
Sec. 3 = 6 × 2.5 = 15 ohms

as the true value of each branch of the network.

•

Solder Pot Constructed By Arc Welding

Although a soldering pot must be designed with side walls and bottom thoroughly insulated, electric arc welding has proved to be a simple and inexpensive means of fabrication. An entire pot can be made with a minimum of materials and in a few minutes time, according to the Lincoln Electric Co., Cleveland, Ohio.

The pot illustrated has an inside bottom and side wall of ½-in. thickness, with a circular top piece ¼-in. thick. The outside shell is of 14-gage mild steel.

The insulation area between the inner and outer walls is 1¼-in. in thickness and is packed with rock wool. Handles are of $\frac{5}{16}$-in. round stock bent into a U as shown and fused to the outside shell by welding both sides.

Inside and outside shells are formed and welded solid at the joint,

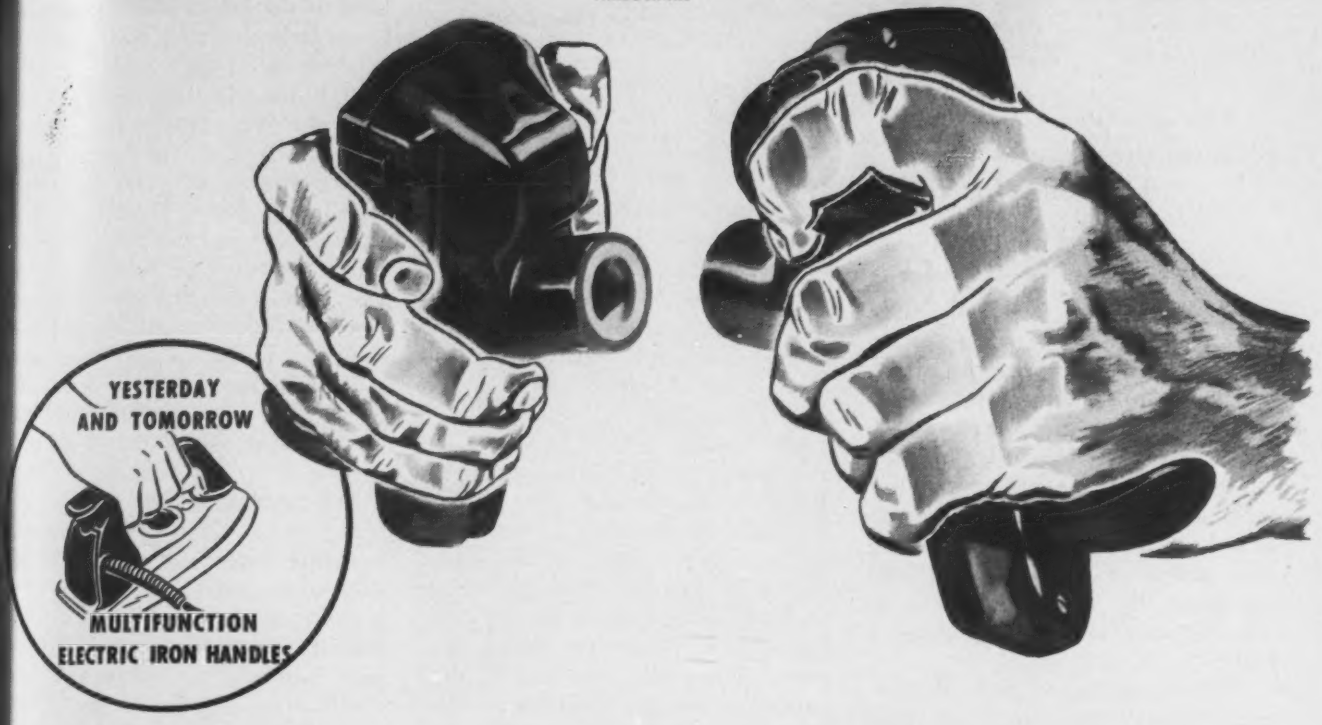
Soldering pot fabricated by arc welding

then finish welded to the top and bottom sections.

A gap of about $\frac{5}{16}$-in. separates the top piece from the sides to help dissipate the heat from the solder and prevent the outside shell from becoming excessively hot. Four intermittent welds are used to join the top piece and sides and thus leave openings so that the heat cannot be easily transmitted at this point.

BAKELITE

TRADE-MARK



Today . . . Two-Fisted Gun Grips

THESE GRIPS, molded from a BAKELITE impact-resistant phenolic plastic, give aircraft gunners instant command of turret rotation, gun firing, and the microphone system. They are miniature switchboards—alive with electrical controls and ready for instant action. But at the same time they are lightweight, tough to withstand impact, and highly dielectric. Temperatures ranging from —70 deg. F. to 180 deg. F. do not affect their form or operation because they are dimensionally stable. Their fine, lustrous, integral finish withstands the roughest handling.

The designing and molding of gun turret control grips closely parallels that of producing peacetime appliances, such as flatiron handles. And both call for the same combination of physical, electrical, and thermal characteristics in the construction material. The right answer for thousands of other products has come from the use of the *right* BAKELITE plastic, plus the coordinated teamwork of designer, molder, and materials supplier.

Our field engineers and development laboratories will gladly work with you on any product that you wish to improve or that is now in the planning stage. Write for Booklet 47M, "Bakelite Molding Plastics."

TRADE MARK

BAKELITE CORPORATION, 30 E. 42 St., New York 17
Unit of Union Carbide and Carbon Corporation

UCC

Molding Plastics

LOAD SERVICING

Commercial
Industrial

Residential
Rural

Plotting the Course for Post-War Sales

By S. R. FINLEY
General Superintendent
Electric Power Board of Chattanooga

Classification of residential customers into groups according to average kilowatt hours used per month is a common method for rate analysis, but it has another large value—determination of direction of sales effort. In anticipation of post-war load building the Electric Power Board of Chattanooga is keeping close watch on residential customer groupings, the record of which for 1943 appears in the accompanying table.

This compilation is made at quarterly intervals and then is averaged for the full year. The quarterly information is not particularly useful except as the basis for the average although it does indicate any changes as they may occur.

Large Appliance Prospects

Assuming that a usage up to 40 kw.-hr. per month does not include use of a refrigerator, range or water heater, it appears that customers in this group are logical prospects for sale of any or all of these appliances. An electric refrigerator will use up to about 60 kw.-hr. per month, therefore, in the group between 40 and 100 kw.-hr. it is assumed that these customers own refrigerators. On the same basis of average appliance consumption it is assumed that those customers in the group of above 100 and less than 300 kw.-hr. have a refrigerator and an electric range, and that those whose consumption averages above 300 kw.-hr. have all three of the major appliances. Spot checks have been made which show that these assumptions are very nearly correct.

It appears from this grouping of customers that those toward whom sales promotional activities should be directed are pretty well defined. The approximately 20 percent of customers in the first group are the ones who should be in the market for range, water heater and refrigerator, the next higher group for ranges and water heaters, and the next for water heaters only.

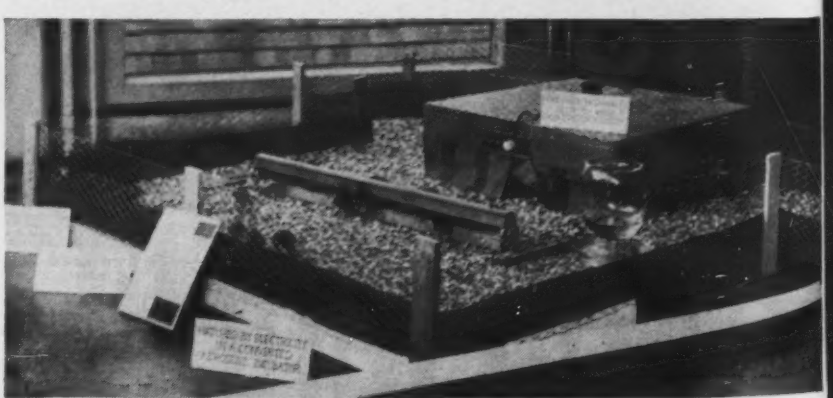
We make a continuous study of meter reading routes to determine how many customers in each route fall into the various use groups. Naturally, depending upon the nature and economic status of the neighborhoods, the data from the meter books is to be tempered with some judgment to determine actual prospects. When the war is over and appliances become available this information will be useful in the spot direction of promotional activities, perhaps to the extent of including in particular customers' bill envelopes promotional literature directed toward the sale of indicated appliances.

In 1941 Chattanooga dealers sold electrical appliances in the volume of $3,365,000. In 1942, the volume was $1,511,000. In 1943 it was $232,000. This tremendous shrinkage indicates the sales opportunity which will come soon after V Day, and which will be worth all of the study and investigation put into it now.

Electric Brooding Serves Turkey Chicks

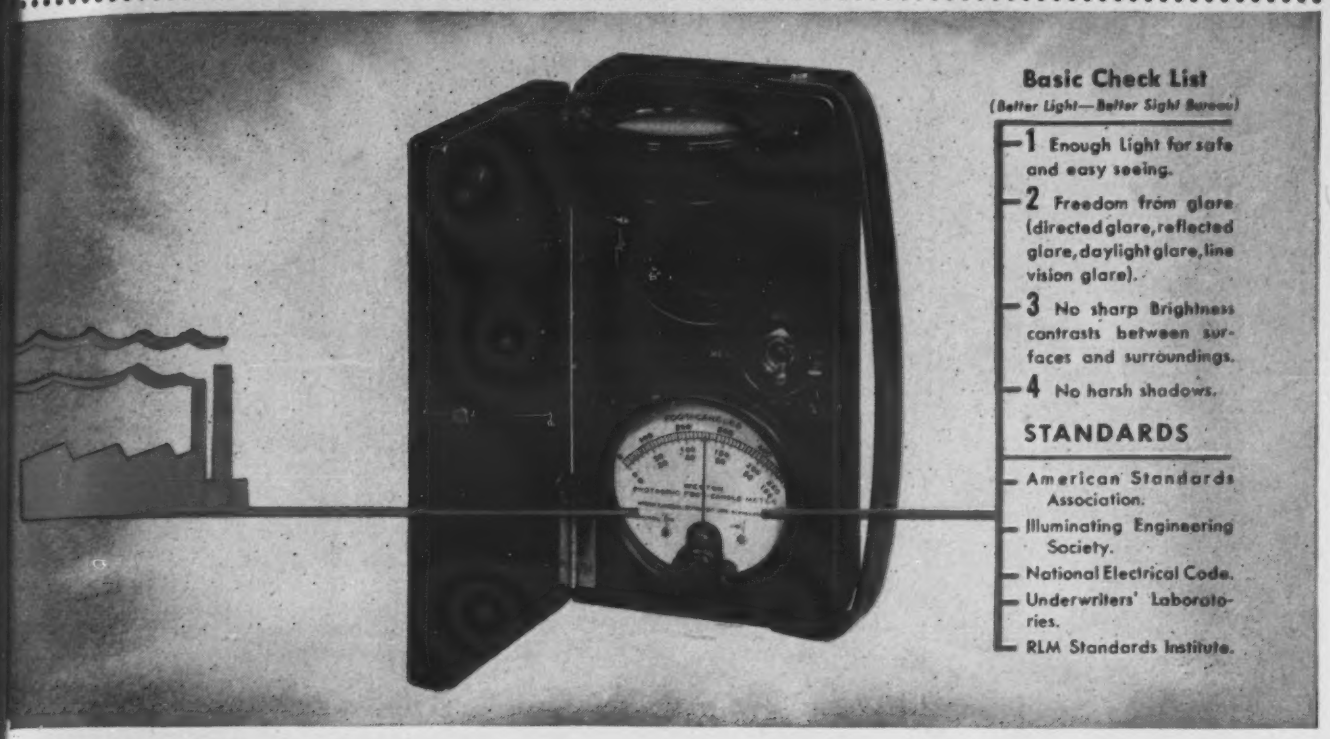
To illustrate the effectiveness of electric brooding of turkey chicks, Freeman Lesperance, Bernard Smith and William Evensen of the Gardner (Mass.) Electric Light Co. set up a window display in which a 660-watt Lyon Defender unit was assembled in a 40-in. square wooden brooder with painted Celotex insulation and utilized to serve chicks belonging to these employees. The hatching eggs were purchased from the Otto Hartman Turkey Farm, Meyersville, Tex., and the electrical unit from the Lyon Rural Electric Co., San Diego, Cal. The eggs were hatched in an old kerosene incubator which had been converted to electric operation, using a 250-watt heating coil. A total of 62 kw.-hr. was consumed in this work during the 26-day incubation period.

The capacity of the brooder was 150 chicks and during the eight-week brooding period about 120 kw.-hr. were consumed by the device. The brooder is equipped with a small electric fan which permits the low head room of 10-in. through the even distribution of heat achieved. Thermostatic control regulates the operation of the heater, and a pilot is provided to indicate when the brooder unit is energized. The litter used in the window was composed of peanut shells. It was pointed out that the standard 660-watt Defender unit electrifies any insulated box up to 66 in. square, with 10 to 11-in. headroom, and that installation involved only boring a 4-in. hole in the box center for fresh air intake, attachment of the heater by three screws and mounting of the thermostat assembly in a slot on the side of the hover.



WINDOW DISPLAY showed electric brooder in operation after construction by utility employees for their own hatchings of turkey chicks

How far is your Lighting from Today's accepted Industry Standards?


Basic Check List
(Better Light—Better Sight Bureau)
1 Enough Light for safe and easy seeing.
2 Freedom from glare (directed glare, reflected glare, daylight glare, line vision glare).
3 No sharp Brightness contrasts between surfaces and surroundings.
4 No harsh shadows.
STANDARDS
American Standards Association.
Illuminating Engineering Society.
National Electrical Code.
Underwriters' Laboratories.
RLM Standards Institute.

TODAY'S accepted lighting standards in Industry are being proven by war production as essential to higher rates and quality of production . . . to employes' maximum safety, health, and morale.

Does your lighting meet these higher Industry lighting standards? Only a job by job and department by department survey of your plant will enable you to determine your answer. Unless your plant has been newly built or has been completely re-lighted within the past three years, you will probably find that for many seeing tasks and in many departments, your employes have insufficient or improper lighting during most of the day and all of the night.

Lighting Deserves Executive Attention

Executive consideration of the lighting question is indicated by the fact that adequate lighting and comfortable seeing in conformance with the American Recommended Practice of Industrial Lighting is a part of the problem of "general working conditions."

Importance of Fixture Design

To provide efficiently and economically lighting that conforms to today's Accepted Industry Standards requires careful selection of properly designed equipment. To be properly designed, equipment must provide proper shielding of the light source to minimize direct glare, provide the proper direction, distribution and diffusion of the light upon horizontal and vertical surfaces and for certain special locations protection against hazards of explosive gases dust and water vapors.

Through the specification of Benjamin equipment assurance is had of equipment design and construction which conforms with all recognized illumination, electrical and mechanical standards as provided by the National Electrical Code and the RLM Standards Institute.

Write for FREE Booklet

Send for a Free copy of the Booklet "Productive Lighting" containing much valuable information on how to obtain best lighting results. With it will be sent complete information on how you may obtain the assistance of a Benjamin Trained Lighting Specialist in analyzing the performance of your lighting and in making recommendations without cost or obligation. BENJAMIN ELECTRIC MFG. Co., Dept. K, Des Plaines, Illinois.

BENJAMIN
TRADE MARK
Lighting Equipment
Distributed Exclusively Through Electrical Wholesalers

THE NEW KELVINATO
Kelvinator

...OME FREEZER!

An important new home appliance for building postwar domestic load

To those electric utilities faced with the task of building up their domestic load in the postwar years, the new Kelvinator Home Freezer is good news.

There are three important reasons why the new Kelvinator Home Freezer can be depended upon to produce retail sales in volume and increase domestic load:

FIRST—a Home Freezer built by a company with *more than 30 years of experience* in the precision building of *low temperature* refrigeration units.

Kelvinator is the oldest manufacturer of cabinets designed specifically for the storage of ice cream and food products at low temperatures.

...ND—a Home Freezer whose refrigeration power ...t—the famed Kelvinator Polarsphere—has a ...en record of *trouble-free operation* unmatched ...ny in the industry.

It is a record established in ice cream cabinets, beverage coolers, household refrigeration and commercial refrigerating units . . . first requisites of which are day-in, day-out uninterrupted performance.

THIRD—a name which has been synonymous with finest of dependable refrigeration in American homes for three decades.

It is a name which will produce *immediate public acceptance* for this great new Kelvinator product.

Plans for getting the new Kelvinator Home Freezers into homes and on utility power lines as quickly as possible after the war are well developed. They are a part of Kelvinator's long-range merchandising plan to get Kelvinator Refrigerators, Electric Ranges, Home Freezers and Electric Water Heaters into use where they will do their part in helping utilities increase their domestic load.

...OOK AHEAD WITH KELVINATOR

DIVISION OF NASH-KELVINATOR CORPORATION

Kenosha • Milwaukee • DETROIT • Grand Rapids • Lansing

Awarded to Nash-Kelvinator Corporation, Propeller Division

Guth

In 1942--We Introduced

QUICK-LITER*

The Original Starterless FLUORESCENT!

No Starter Switches
Maintenance cost is lower, and the problem of chucking for "dead" Starters is eliminated.

Lights Instantly
At the flick of the switch—there's light! No flickering, flashing, or waiting.

Long Lamp Life
QUICK-LITER gets maximum usage from lamps.

Operates at Irregular or Low Voltage
QUICK-LITER *starts and operates at as low as 85 Volts.*

Would Operate in an Ice Box
QUICK-LITERS start and operate as low as 0° F. Temperature. Many are now in use in Alaska and the Aleutians.

Immediately Available
QUICK-LITERS can be shipped at once on AA-5, or AA-2-MRO, or higher priorities.

Two Years of Rigid Testing Have Proved Its Worth!

The GUTH QUICK-LITER was originated for War Plants; where high maintenance costs due to Starter-Switch troubles, and variable line-voltage conditions, made *Starterless* Fluorescent desirable. Detailed performance records were maintained, so that every claim made for QUICK-LITER has been *proved* by use.

A valuable report on the results of these tests is now available. Write for your copy today.

Guth *QUICK-LITER
TRADE MARK

The Edwin F. Guth Co. • 2615 Washington Ave. • St. Louis 3, Mo.

ginnings with a series of institutional advertisements in "The Municipality", a publication issued to members of the League of Wisconsin Municipalities. These early ads told the story of good street lighting, dependable gas service and local transportation service in terms of the utility industry's contribution to community, state, civic and economic life.

Like the current series, these ads were signed "Your Electric Service Company" or "Your Gas Service Company," or "Your Local Transportation Company," rather than by Wisconsin Utility Association in order to achieve intensive local reader interest. Localization of the message was the aim then as now and the principle has been followed consistently.

Effort in the current series of advertisements has been to focus on Wisconsin's accomplishments in pioneering and advancing rural electrification. Objective has been to remind the Wisconsin farmer vital and interesting history of rural electrification in the state and of the part that business managed utilities contributed to its origin and progress.

Encourage Line Construction

The series tell arrestingly how Wisconsin utilities organized an Association committee to encourage rural line construction and the promotion of electric service to farmers; of the early enlisting of farm equipment manufacturers, farmers and professors of the University of Wisconsin to encourage experimentation and to promote sound rural electrification developments.

Told also is the engrossing story of the Ripon experimental rural line and the enterprising farmers, who in cooperation with the utilities Association the State University, farm organization and equipment manufacturers offered the use of their farms to demonstrate to others that electric service would save time and labor and pay the farmer profits.

With this historical story the program is reminding Wisconsin farmers that rural electrification was started and pioneered by utilities operating under the American enterprise system of free opportunity. It tells of the contribution of enterprising farmers, manufacturers and university professors working together, and shows that electric companies can be depended

MOLONEY

UNIT SUBSTATIONS WITH ASKAREL, AIR, OR OIL-COOLED TRANSFORMERS

MOLONEY Load Center Type UNIT SUBSTATIONS

ILLUSTRATED is a 1000 Kva Moloney Unit Substation used in an industrial plant for load center power distribution. Transformer is Askarel-cooled permitting installation indoors without the expense of a fireproof vault. Locating substation at center of load eliminates long runs of expensive secondary copper. Better regulation increases voltage at points of use, improving performance of equipment served. Unit construction incorporating primary switch, transformer and secondary air circuit breakers simplifies installation and operation.

Load Center type Unit Substations such as this are available with Air-cooled or Askarel-cooled transformers for indoor installation, and Oil-cooled or Askarel-cooled transformers with weatherproof switchgear construction for outdoor use. Unit Substations can be supplied with primary air circuit breakers, selector switches, load break switches, power fuses, metering equipment, or any other desired features.

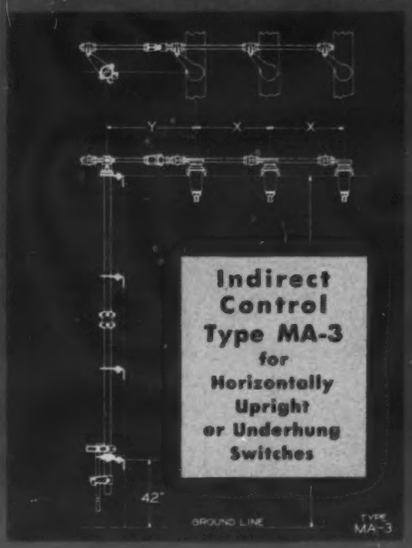
MOLONEY ELECTRIC COMPANY • ST. LOUIS, U. S. A.

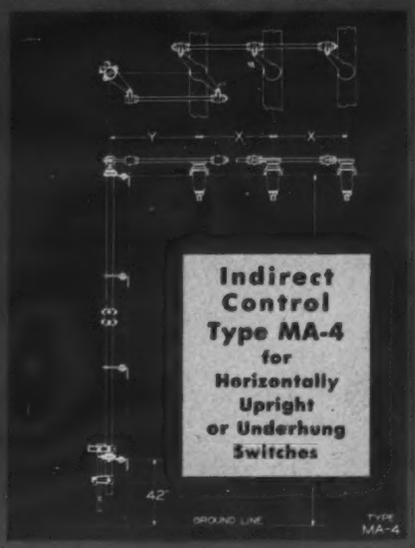
SALES OFFICES

Alexandria, Va. . . . . 401 Doniphan Bldg.	Detroit, Mich. . . . . {16125 Grand River Drive {744 New Center Bldg.
Adanta, Ga. . . . . 217 Whitehall St., S. W.	Grand Rapids, Mich. . . . . 412 Houseman Bldg.
Birmingham, Ala. . . . . 1814 First Avenue, North	Houston, Texas. . . . . 4411 Navigation Blvd.
Bluefield, W. Va. . . . . 201 Union Street	Indianapolis, Ind. . . . . 909 Roosevelt Bldg.
Boston, Mass. . . . . Statler Office Bldg.	Kansas City, Mo. . . . . 624 Dwight Bldg.
Charlotte, N. C. . . . . 124 Brevard Court	Knoxville, Tenn. . . . . Harrill Hills
Chicago, Ill. . . . . 100 West Monroe Street	Los Angeles, Calif. . . . . 124 W. 4th St.
Dallas, Tex. . . . . 709 Thomas Bldg.	Minneapolis, Minn. . . . . 643 Midland Bank Bldg.
Denver, Colo. . . . . 612 Insurance Bldg.	New Orleans, La. . . . . 428 Balter Bldg.
New York, N. Y. . . . . 55 Liberty Street	
Omaha, Nebr. . . . . 503 Sunderland Bldg.	
Pittsburgh, Pa. . . . . 837 Oliver Bldg.	
Portland, Ore. . . . . 1233 N. W. 12th Avenue	
St. Louis, Mo. . . . . 5390 Bircher Boulevard	
Salt Lake City, Utah . . . . . 314 Kearns Bldg.	
San Francisco, Calif. . . . . 420 Rialto Bldg.	
Seattle, Wash. . . . . 532 First Avenue, South	
Shreveport, La. . . . . 630 Spring Avenue	

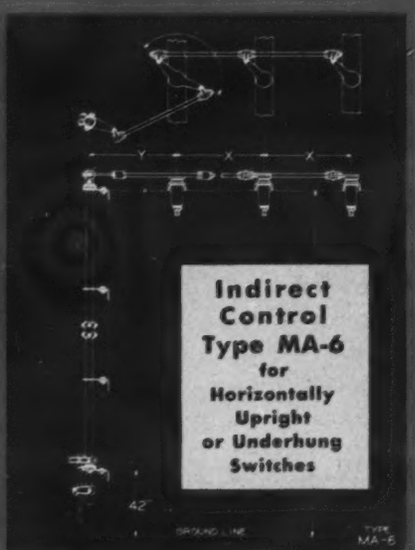
Specific Switch Operating Functions are met with versatile

HI-VOLTAGE Switch Arrangements





Shown are several typical mechanism arrangements that can be used with any one type Hi-Voltage Switch . . . No field drilling or cutting is required with this type of mechanism. They are completely machined, ready to install, at the factory. Installation time is a part of your switch cost. You'll find a real saving when Hi-Voltage mechanism is used.



HI-VOLTAGE
EQUIPMENT COMPANY
2891 East 79th Street · Cleveland 4, Ohio

upon to bring more and greater benefits to farmers in the years ahead.

Reactions to the program have been favorable. Practically all of the utility companies in the state are reproducing the advertisements at their own expense in weekly and some daily newspapers in their own territories under their own signature.

•

Illumination By Invisible Light

The illumination of objects by invisible light is the result of one of the newer adaptations of plastics to the electrical field. This development often termed "Black Light" becomes the source of light needed for dial and sign illumination, safety guides, inspection lamps, and x-ray equipment. A stove manufacturer has found it adaptable to lighting the rear recesses of the range. In this adaptation a plastic filter is placed over one end of the range's fluorescent tube. And in this manner, the white light will illuminate the range while that portion which filters through the tube is used to throw black light on a number of dials which glow at readings of oven temperature, the time, and other indications.

The commercial applications for invisible light also have a wide range. Now used to light up instrument dials in cockpits, after the war it is expected to illuminate radio and television dials, control knobs, switches, door handles and other common objects.

The filter, developed by J. M. Gordon, consultant and research engineer for Lion Manufacturing Corporation, Chicago is adaptable to any size of fluorescent tubular style lamp.

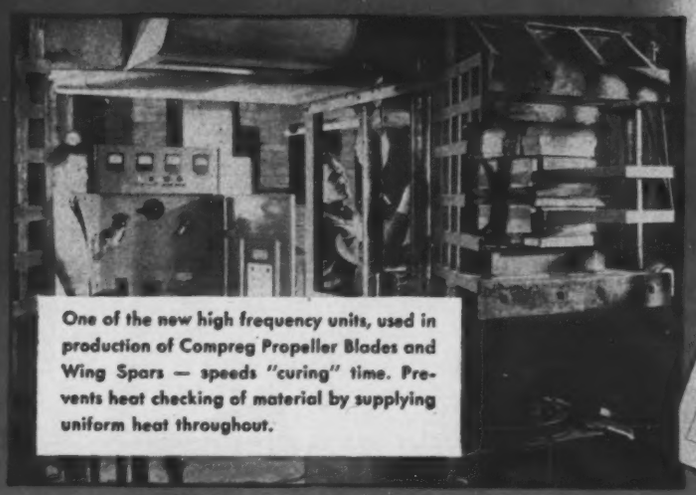
•

Add Conference Sponsor

Radio Manufacturers Association Parts Division has become a co-sponsor of the forthcoming Electronic Parts & Equipment Industry Conference along with the National Electronic Distributors Association, Sales Managers Club (Eastern Division), and the Association of Electronic Parts & Equipment Manufacturers. The conference will be held October 19-21 at the Stevens Hotel, Chicago.

Electronic Heating Increases Use and Extends Applications of PANELYTE* COMPREG

PANELYTE Compreg Propeller Blades — rotary cut veneer impregnated with phenol-formaldehyde. It possesses extremely high tensile, compressive and flexural strength. Carving is done by Engineering Research, Riverdale, Md.



One of the new high frequency units, used in production of Compreg Propeller Blades and Wing Spars — speeds "curing" time. Prevents heat checking of material by supplying uniform heat throughout.

This popular R.C.A. advertisement featured electronic heating apparatus used in manufacture of Compreg.

This laminated resinous plastic with wood veneer base is superior to wood in dimensional stability, strength uniformity and resistance to moisture and decay. Panelyte Compreg is superior to light alloys in weight saving and resistance to fatigue failure, erosion and corrosion.

"Gluing by radio waves" cuts "curing" time from hours to minutes — saving production time and costs.

Compreg is preeminently suited to all structural beam applications, within sizes available in the material. Compreg's early use in circuit breaker rods indicates its adaptability in electrical design. Compreg is also a good heat insulating material, and this, coupled with its high strength, makes it ideal for supports in magazines and cold storage units in ships. It prevents heat conduction from deck plates and bulkheads, which occurred when steel supports were used.

Samples and full technical data immediately available.

*Mass production of sheets, rods, tubes, molded forms and fabricated parts in paper, fabric, wood veneer, fibre glass and asbestos base thermo-setting plastics.

PANELYTE *the structural plastic*

PANELYTE DIVISION
ST. REGIS PAPER COMPANY
230 PARK AVENUE
NEW YORK 17, N. Y.

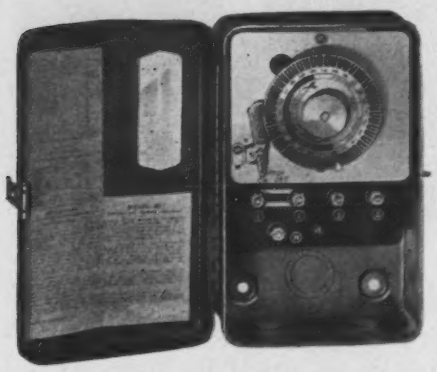
Sales Offices: Atlanta, Boston, Chicago, Cincinnati, Cleveland, Dallas, Denver, Detroit, Kansas City, Los Angeles, Montreal, New Orleans, St. Louis, St. Paul, San Francisco, Seattle, Syracuse, Toronto, Trenton, Vancouver

MASS PRODUCTION OF SHEETS, RODS, TUBES, MOLDED FORMS, FABRICATED PARTS

AMERICA'S "TOPS" IN TIME SWITCH PERFORMANCE

Mr. "Tops," the Paragon symbol of top quality

. . . an accurate, durable self-lubricating time switch for controlling stokers, oil burners, blowers, pumps, valves, air conditioning, etc. . . . . for only $13.00 list.



JUST TWO EXPOSED GEARS. All others constantly lubricated because they operate in a sealed oil bath.

DUST PROOF. Because of the sealed-in features, dust has no effect upon the operation.

SLOW SPEED MOTOR. The first and only low priced Time Switch to be timed and operated by slow speed (450 R.P.M.) industrial type self-starting synchronous motors.

FOR LOW TEMPERATURE. Guaranteed to operate successfully at temperatures as low as 20 degrees below zero.

SELECTION OF SWITCHES. Switches available: single pole single throw, double pole single throw or single pole double throw.

Send for complete engineering bulletin. Paragon manufactures a wide range of industrial timers, time delay relays, panel boards and other electrical equipments

PARAGON ELECTRIC COMPANY
703 OLD COLONY BUILDING
CHICAGO 5, ILLINOIS

Paragon Chicago
BUILDERS OF ELECTRICAL EQUIPMENT SINCE 1905

Utilities Tell History Of Rural Electrification

HOW AND WHEN DID RURAL ELECTRIFICATION START?

WISCONSIN ELECTRIC SERVICE COMPANIES

Advertisements like this one, appearing in Wisconsin agricultural journals are telling farmers of the origin and development of rural electrification by private utilities, manufacturers, and the state university and farm organizations. The series is sponsored cooperatively by electric service companies through the Wisconsin Utilities Association

If you thumb through this year's copies of either the "Wisconsin Agriculturist" or "Dairyland News", leading agricultural journals in Wisconsin, you will find in each a number of friendly advertisements recounting the history of rural electrification's advance in the state since 1923. Searching out the signature line you will read: "This advertisement is sponsored by Wisconsin Electric Service Co.'s under American business management."

These advertisements are part of a cooperative advertising program sponsored by Wisconsin utilities through their own state association. It is believed to be one of only a few such regional cooperative advertising programs now being conducted.

Wisconsin utilities have been doing such cooperative advertising for about four years. It had its be-

PERMATOX "A"

(A Straight Toxic Wood Preservative)

For Reclaiming OLD POLES and Preserving NEW POLES

PREVENT Costly Pole Failures

With the pole shortage becoming more critical, it is vitally necessary to get the utmost service from every pole in stock or installed on your lines.

PERMATOX "A" (5% pentachlorphenol in suitable petroleum solvents) affords an effective, economical preservative treatment . . for the control of decay, shell-rot and termite attack.

Specify it for poles, posts, cross-arms, ties, crossing planks, bridge timbers and other exposed construction. Soaking or pressure treatment insure adequate absorptions and deep penetration.

●

Furnished in Two Forms:—

DOWICIDE 7
Pentachlorphenol* crystals

PERMATOX "A"
5% Pentachlorphenol* in suitable petroleum solvents

*Manufactured by The Dow Chemical Company

Write for Bulletin

A. D. CHAPMAN & COMPANY, INC.
333 N. MICHIGAN AVE. CHICAGO 1, ILL.
Memphis Portland
New Orleans New York

SLAM THE DOOR ON TERMITES!

Dowicide can be an important part of your plant protection force—standing as an ever-vigilant guard at your doors to keep mold and decay out.

There are seventeen related products in the Dowicide family—each designed for a specific assignment . . . each thoroughly tested and proved by years of use in many industries.

Dowicide has also proved its worth many times in preserving lumber, overhead wires, and underground cable.

Lumber may be treated with Dowicide by impregnating or dipping, producing lumber that is paintable, nonbleeding, easily handled, and fully protected against rot and termite attack.

Write for complete information on how to prevent the destructive inroads of rot and termites.

THE DOW CHEMICAL COMPANY
MIDLAND, MICHIGAN

New York • Boston • Philadelphia • Washington • Cleveland
Detroit • Chicago • St. Louis • Houston • San Francisco
Los Angeles • Seattle

Among the many other Dow products serving the Lumber Industry are: Ethocel, Methocel, Styrene, Dowtherm, and Phenol.

DOWICIDE

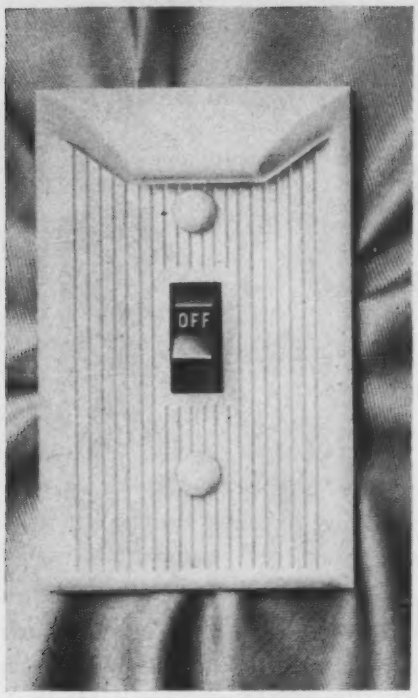
GERMICIDES AND FUNGICIDES

DOW

CHEMICALS INDISPENSABLE TO INDUSTRY AND VICTORY

NEW EQUIPMENT

Switch Plate



"Lumi Nite" molded wall switch plate; fits standard switch; suitable in 3- and 4-way switch arrangements. **Associated Products Co.**, 74 East Long St., Columbus 15, Ohio.

Single piece, ivory plastic plate has housing at top for fractional-wattage glow lamp and mechanism. Lamp comes on automatically when room lights are turned off and remains off when room lights are burning.

•

Heaters

Electric contact type heaters; power consumption ranges from 35 to 400 watts depending on size and shape of units. **H. & A. Manufacturing Co., Inc.**, 86-100 Leroy Ave., Buffalo 14, N. Y.

Face of the heating plate is held in compressive, resilient contact against the surface through which the heat is to be transferred. Units in most cases can be "sprung" onto the object, no nuts or bolts or permanent attachments ordinarily are required, it is stated. Thermal losses are said to be so well controlled and heat transfer so efficiently accomplished that a unit weighing only a few ounces will raise the temperature of 30-odd pounds of steel 90 deg. above sub-zero external temperatures.

Fire Extinguisher

"S.O.S. Fire Guard"; sizes 1 or 1½ qt. **General Detroit Corp.**, 2270 East Jefferson Ave., Detroit 7, Mich.

Vaporizing liquid type fire extinguisher has been designed for use on vehicles and its action is said to be particularly fast on electrical, oil and gasoline fires. It features the pump cylinder expanded at the bottom to insure immediate free-floating piston action even after long periods of disuse, also a panic-proof safety lock actuated by turning handle either right or left.

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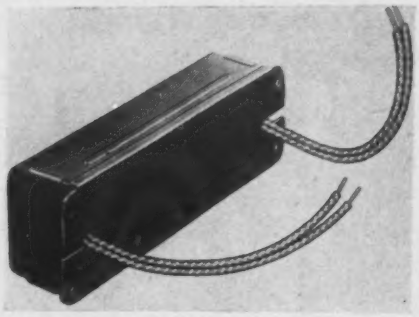
Ballast



Tulamp ballast; high power factor; **General Electric Co.**, Schenectady, N. Y.

High voltage ballast for operation with instant-starting fluorescent lamps. Applies 450 v. to lamp at starting, striking an arc between lamp cathodes and thus eliminating separate starter equipment. Designs said to provide high power factor and give correction of cyclic light flicker. Filters for suppression of radio interference are reported to be incorporated. Leads may be brought out either end or the bottom permitting flexibility of installation and utilization of present fixture design.

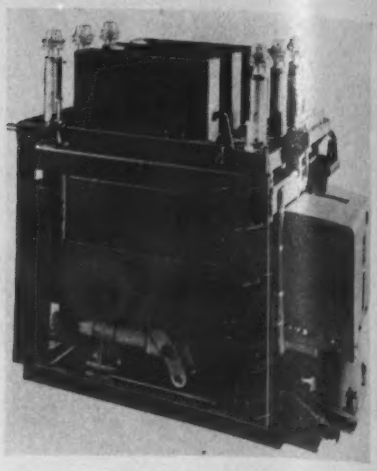
•

Comparison Bridge

Type "LB" direct-indicating comparison bridge: ranges; capacitance, between 0.0001 and 1.0 mf.; resistance, between 2,000 ohms and 20 megohms; inductance, between 5 and 50,000 henries. **Industrial Instruments, Inc.**, 17 Pollock Ave., Jersey City 5, N. J.

Instrument is an a.c. slidewire bridge with vacuum-tube null indicator arranged so that resistors, capacitors or inductors can be compared with a similar standard. Limits may be set with any combination of high or low value; such as minus 6 percent, plus 14 percent. Slide wire is uncalibrated; external standards are used.

Air Circuit Breaker



"Ruptair" magnetic type air circuit breaker; 5,000 v.; 150,000 kva. interrupting capacity; **Allis-Chalmers Mfg. Co.**, Milwaukee, Wis.

Air breaker for use in vertical-lift metal clad switchgear equipment has an arc chute said to be designed to coordinate with the contact and arc runner to give consistent and reliable interruption through the entire range of current to be interrupted. Magnetic circuit, consisting of one blowout coil and two laminated iron pole pieces per phase, is reported to be arranged to force the arc up into the arc chute. It is reported that inspection and maintenance of contact assembly can be accomplished without disturbing the arc chute or magnetic circuit.

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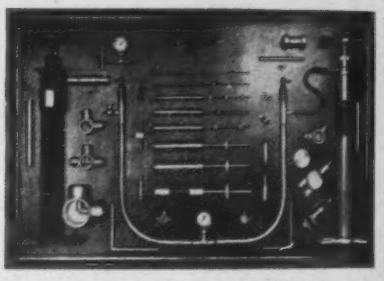
Display Cabinet



Display Cabinet for UHF "plumbing"; **Andrew Co.**, 363 East 75th St., Chicago 19, Ill.

Display cabinet for meeting and lecture use. Collection of coaxial transmission lines of various diameters with some of the commonly used connectors, junction boxes and terminals are shown.

•

Rectifier

Rectifier GE 2,000; 12 kw. output; **General Electric Co.**, Schenectady, N. Y.

Different output ratings are possible with this unit-6 volts, 2,000 amp. or 12 volts, 1000 amp.; 24 volts, 500 amp. or 48 volts, 250 amp. Has two separate secondary circuits each feeding a separate bank of copper-oxide rectifier stacks which may be connected in series or parallel. Available in two a.c. supply ratings: 230 volts or 440 volts, three phase, 60 cycles. Designed for floor mounting with air intake at the bottom and exhaust at the top.

"Making Big Ones out of Little Ones"

With most of our lumbermen handling knives and walnut gun stocks instead of axes and cedar, pole replacements are somewhat of a problem in many localities. Add to this, the difficulties of shipping and handling heavy materials amidst war time traffic congestion and the result is a scarcity of poles for some of our Utility Companies.

The problem is being partially solved on a temporary basis by pole stubbing. Discarded poles with rotted bottoms but firm wood above the original ground line are used as stubs. After cutting away the rotted butt and treating, stubs are set alongside the pole which is in service but in need of replacement Hubbard Sleeve-Nut Bands are installed as shown in the diagrams.

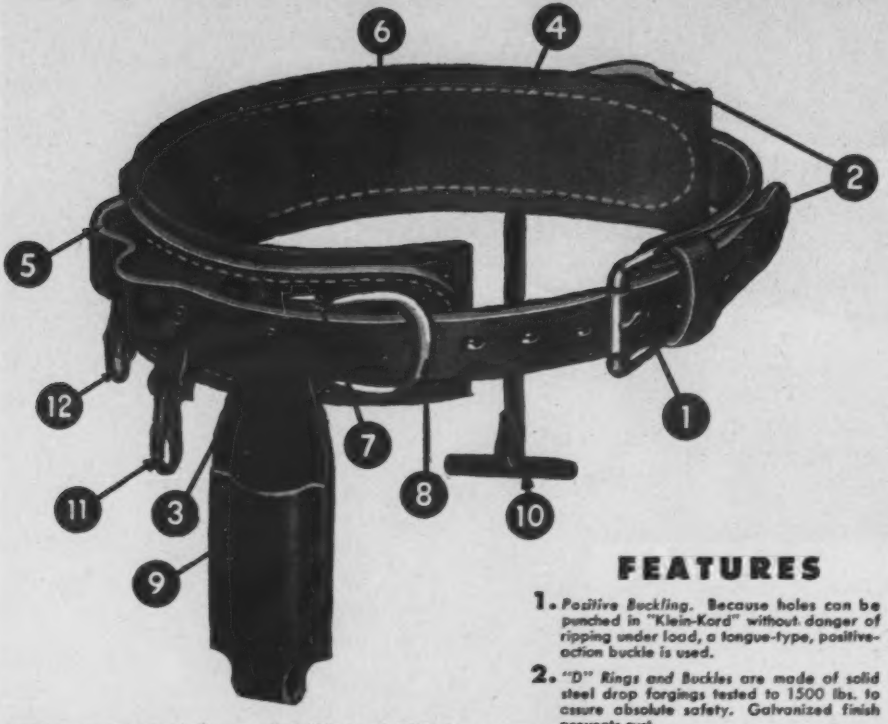
Given a solid setting for the stub, the resultant structure will hold to the breaking strength of the average pole, as illustrated by the accompanying photo of a test.

HUBBARD AND COMPANY

PITTSBURGH OAKLAND CALIFORNIA CHICAGO

ANNOUNCING ... the NEW

"KLEIN-KORD" TOOL BELT



THE PROVED dependability of "Klein-Kord" Safety Straps has led to the development and introduction of the No. 5204-KK "Klein-Kord" Tool Belt.

Made from multi-ply, specially woven long staple cotton, with each ply laid in rubber and vulcanized, "Klein-Kord" is a strong, yet flexible, fabric that: (1) is of uniform quality; (2) resists absorption of moisture and detrimental effects of climate; and (3) does not stretch. It has a tensile strength many times that demanded in actual service.

You'll find that comfort, safety and efficient design—important to every lineman—are built-in features of this new "Klein-Kord" Tool Belt. All workmanship and materials are of the highest quality—quality that has been typical of the name Klein since 1857.

FEATURES

1. *Positive Buckling.* Because holes can be punched in "Klein-Kord" without danger of ripping under load, a tongue-type, positive-action buckle is used.
2. *"D" Rings and Buckles* are made of solid steel drop forgings tested to 1500 lbs. to assure absolute safety. Galvanized finish prevents rust.
3. *Rivets.* All rivets are solid copper, hand set with burrs for added safety and strength.
4. *Sewing.* All sewing is done with hot waxed harness thread and lock stitched.
5. *Four Tool Loops,* conveniently located, are formed by the body strap.
6. *Canvas Lining,* 4½ inches wide, covers all rivets—an insulating feature that assures safety. Lining also absorbs body moisture to increase comfort of lineman.
7. *Metal Safety Clips,* riveted through main belt at "D" rings, prevent swing of "D" rings beyond 90 degrees from belt.
8. *Body Strap* passes through "D" rings for maximum safety.
9. *Plier Pocket* of "Klein-Kord".
10. *Tape Thong* with fibre cross bar.
11. *Knife Snap.*
12. *Handy Loop* for glove pouch.

This book on the care and safe use of tools will be sent on request.

ASK YOUR SUPPLIER

Foreign Distributor: **International Standard Electric Corp., New York**

Mathias KLEIN & Sons
Established 1857
Chicago, Ill., U.S.A.
3200 BELMONT AVENUE, CHICAGO 18, ILLINOIS

Since 1857

TECHNICAL LITERATURE

Lubrication—How centralized lubrication systems increase the production output of machinery and at the same time make impressive savings in time, power and lubricating materials, is the theme of Bulletin No. 25, published by the Farval Corp., Cleveland, Ohio. Booklet is a graphic portrayal of the theory and practice of mechanical lubrication. Opens with a study of the machinery lubrication problem and of the economies that are inherent in a system which delivers lubricant to all bearings in exact amounts. The construction and operation of both manual and automatic pumping units, which provide the high pressure source of lubricant supply, are treated. The center spread is devoted to the economies of positive mechanical lubrication, and concludes with a selection of 24 application photographs.

Call Systems—Signal and Communication Systems for Hospital and Nurses' Homes is bulletin 1045 published by Faraday Electric Corp., Adrian, Mich. Treated in its 40 pages are all the call, light, and communication systems for hospitals and kindred institutions. In the back are typical wiring diagrams of such installations, a table of conduit sizes for low voltage signal system, wire combinations and an explanation of how to figure transformer capacities for low voltage lamp signal systems.

Boiler Meters—Cochrane Corp., 17th St., Philadelphia, Pa., has issued a publication (No. 4071) in which the introductory pages describe the methods of checking combustion efficiency in boiler plants. Following is a treatise on "What Constitutes an Ideal Boiler Meter."

Fastener—A 16-page booklet, illustrated with photographs and drawings and describing the uses to which the new fastener can be put, may be procured from the Simmons Machine Tool Corp., of Albany, N. Y. It is called "Simlok, the Fastener of Today with the Design of Tomorrow."

Also explained are how many industries can make use of the fastener; among them being aircraft, railroads, ships, refrigerators, washing machines, radio, makers of electric panels and many others currently engaged in postwar designing and manufacturing.

Springs—"Handbook of Technical Data on Springs, 236 pages of tables, drawings and information for designers and others interested in springs. Handy reference and guide book may be procured from Accurate Spring Manufacturing Co., 3811 West Lake St., Chicago, Ill.

Windup Machines—Engineering folder may be had from the Industrial Oven Engineering Co., 11621 Detroit Ave., Cleveland 2, O., describing the constant-speed constant-tension windup machine for wire, cable, rubber, tape, fabrics and other continuous materials. Folder describes what it is and how it works.

Panelboard Conversion Plan—A 16-page board describing a method of converting obsolete and inadequate electric light and power panelboards to modernness without disturbing the box or conduit. Booklet has several "before" and "after" illustrations accompanied by a brief history of each case. Booklet CA-575 may be procured from Square D Co., 6060 Rivard St., Detroit 11, Mich.

Cerium—A folder "Some Basic Facts About Cerium" may be had by addressing Cerium Metals Corp., 522 Fifth Ave., New York 18, N. Y. Also contains indicated applications such as in magnesium castings, stainless steel, resistance and heat resistant alloys, bearing metals, refractory metals and compounds, tool steels, welding arc and other electrodes, electronics and as a catalyzer.

Still time to enter!

$1600—14 CASH PRIZES

First	$500
Second	$300
Third	$200
Fourth	$100
Ten	each $50

In the event of ties, duplicate prizes will be awarded.

FLUORESCENT FIXTURE *Design Competition**

OPEN ONLY TO UTILITY LIGHTING PEOPLE

* *For the best designs of a commercial shielded fixture employing four 40-watt fluorescent lamps*

You can still submit your fluorescent fixture design in this competition sponsored by Sylvania, but send for your entry blank today. Entry blanks must be postmarked before midnight, October 1, 1944, and designs must be postmarked before midnight December 1, 1944.

Mechanical drawing is not necessary to win. What our judges will look for will be new and practical ideas for improving fluorescent fixtures — ideas which you may have gathered by actual experience in the field. Here is your chance to make a constructive contribution to the relighting of America. Write today for your entry blank to: Sylvania, Salem, Mass., or use the coupon below.

IT'S EASY TO COMPETE

The Sylvania Competition is open to anyone connected with the lighting division of a public utility — either private or government owned. Sketches submitted do not have to be masterpieces of draftsmanship, but should include dimensions and essential design and construction features. Send for complete rules.

TO GET YOUR ENTRY BLANK
MAIL THIS TODAY!

POINTS OF JUDGING

Our distinguished panel of judges will select the winning designs on the following basis:

1. ***Appearance*** 2. ***Installation flexibility***
3. ***Maintenance*** 4. ***Shielding***
5. ***Efficiency***

JUDGES

HOWARD M. SHARP
President, Illuminating Engineering Society

ALLAN E. PARKER, Ph.D.
Professor of Physics, Worcester Polytechnical Institute

C. A. CARPENTER
Electrical Engineer, Graham, Anderson, Probst & White

LURELLE GUILD
Consultant on Product Design

The Leading Manufacturer of Fixtures in the Fluorescent Field

SYLVANIA
ELECTRIC PRODUCTS INC.

SALEM, MASSACHUSETTS

SYLVANIA ELECTRIC PRODUCTS INC., Boston St., Salem, Mass.

This is to notify you that I propose to submit an entry to the Fluorescent Fixture Design Competition sponsored by your company. I understand that my design must be mailed before midnight December 1, 1944 to qualify for judging. Please send complete rules and official entry blank.

Name_____

Position_____

Public Utility_____

Address_____

City_____ State_____

NEWS ABOUT PEOPLE

Ward Leonard Electric Elects Five New Officers

At a recent meeting of the board of directors, the Ward Leonard Electric Co., Mt. Vernon, N. Y., elected five new officers. Leonard Kebler, president of the company since 1904, was made chairman of the board, a new office, and Dawson J. Burns, vice-president, was named president to succeed Mr. Kebler. Other new officers elected included Arthur A. Berard, executive vice-president and general manager; A. W. Borghard, vice-president and manager of special accounts; and Frank G. Logan, vice-president and manager of research and development. Louis H. Haight, secretary and treasurer since 1933, continues in that office.

Mr. Kebler entered the employ of the company in 1899 when he was fifteen years old. Until 1903 he attended Columbia University in the winters and worked in various departments of the company in the summers. In 1904 he became a director and president and has so served since that time.

Mr. Burns, the new president, entered the employ of the company in 1902. He became a director in 1903, and vice-president in 1909, the position he occupied at the time of his recent promotion.

Mr. Berard, who has just assumed the duties of executive vice-president and general manager, joined the company in 1920, and served successively as salesman, general works manager and general sales manager. He has been a director since 1927.

Mr. Borghard held the title of manager of special accounts before his recent appointment to the position of vice-president and manager of special accounts. He joined the company in 1919, became a director in 1934 and manager of special accounts in 1940.

Mr. Logan has been identified with Ward Leonard since 1927. He was made a director in 1937, manager of research and developement in 1940 and became manager of the regulator division when it was formed in 1941.

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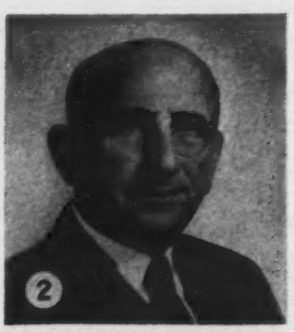
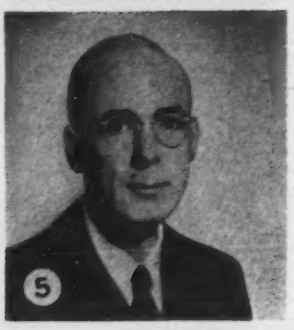
▶ E. H. KIFER has assumed the duties of general manager of the City Public Service Board, San Antonio, Tex. W. B. Tuttle is chairman of the board. Both Mr. Kifer and Mr. Tuttle were identified in executive capacities with the San Antonio Public Service Co., before the properties were acquired by the municipality.



1. Leonard Kebler
2. D. J. Burns
3. A. A. Berard
4. A. W. Borghard
5. F. G. Logan



Oklahoma Gas Appoints Darden Sales Manager

Wayne A. Darden, for 19 years a member of the Oklahoma Gas & Electric Co., has been made general sales manager to succeed the late Alfred A. Brown, George A. Davis, president of the company, has announced.

Mr. Darden, who is 51 years old, was born in Belton, Texas. He is a graduate of Pratt Institute, Brooklyn. Prior to his service with O. G. & E. Co., Mr. Darden was employed by the Texas Power & Light Co. at Dallas.

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▶ JAMES H. MILLER, superintendent, electrical department, Wisconsin Steel Co., has been elected president of the Electrical Maintenance Engineers of Chicago. HARRY C. BUCKLES, chief electrician, Ingersoll Steel & Disc Co., was elected vice-president.

▶ JED F. WOOLLEY, JR., for seven years manager of the Utah Light & Traction Co. before its sale to Salt Lake City Lines, was recently appointed construction and maintenance superintendent for the Utah Power & Light Co.

▶ FREDERICK B. JOHNSON, formerly apparatus engineer, has been appointed assistant chief testing engineer of Commonwealth Edison Co., Chicago. He succeeds William S. Eldredge who retired recently. New apparatus engineer is JOHN W. BARING, previously head starting engineer.

▶ FRANK E. BELL, formerly construction engineer and acting project manager for the TVA Watts Bar project, has joined the Maxon Construction Co., Inc., in Dayton, Ohio. Mr. Bell brings to this company a wide and varied experience in hydro, steam and electrical engineering and construction experience. A

A Live Wire in 1911—

THE OIL CIRCUIT-BREAKER illustrated, featured in a 1911 issue of ELECTRICAL WORLD, would find little favor with ctrical Engineers today. C-D electrical insulating materials ve kept pace with the improvement and refinement of Circuit-eakers . . . including the development of Air Circuit Breakers, ich have been accomplished since 1911, in which year C-D de its first sheet of Laminated Phenolic Material, DILECTO. C-D experience is not limited to one type of electrical insulat-g material. The "know how" accumulated by the C-D Labora-y in solving thousands of electrical insulating problems includes perience with Vulcanized Fibre, Mica, and Molded Phenolic stics as well as with Laminated Phenolic Plastics. Two new ctrical insulating materials, DILECTENE and VULCOID, are the oducts of C-D "know how." These new insulating materials are ermediate to the four standard C-D electrical insulating ma-rials, and meet problems not solved by them.

When you have an electrical insulating problem, think first of D. Let the C-D Laboratory study your problem. C-D technicians l make recommendations based on experience with 6 different pes of insulating materials. Send today for booklet GF—What Material?"

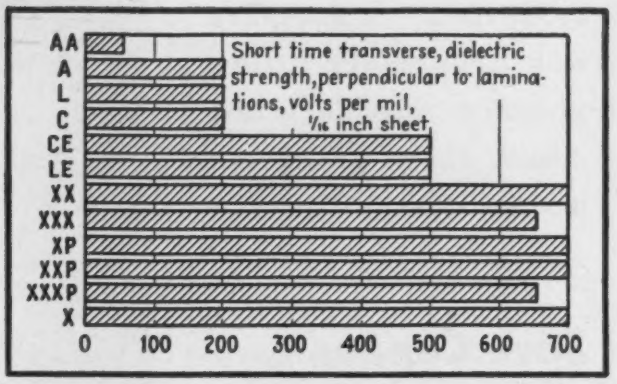
STRICT OFFICES: New York - Cleveland - Chicago - Spartanburg, S. C. st Coast Rep., Marwood, Ltd., San Francisco - Sales Offices in principal cities

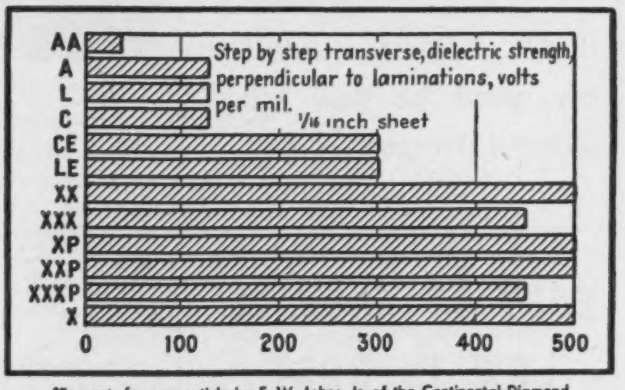
DIELECTRIC STRENGTH OF C-D ELECTRICAL INSULATING MATERIALS*

Dielectric Strength is the factor which largely determines whether or not a particular material is the right choice for a specific insulating problem.

In the commonly used test methods (ASTM D 229, ASTM D 149) determinations for dielectric strength are made in oil kept at the same temperature as the test specimen. The electrical stress can be applied either by the "short time" or the "step-by-step" method. In the "short time" procedure, the voltage is continuously increased at the rate of 0.5 kilovolt per second. In the "Step-by-step" method, the initial voltage is adjusted to 50% of the "short time" breakdown value and then increased as shown in the following table, the voltage being held at each step for one minute.

Breakdown voltage by Short Time method	Increment of Increase of Test voltage
25 KV or less	1.0 KV
over 25 KV to 50 KV inclusive	2.0 KV
over 50 KV to 100 KV inclusive	5.0 KV
over 100 KV	10.0 KV





*Excerpts from an article by F. W. Jahns, Jr. of the Continental-Diamond Laboratory Staff. A copy of the complete article will be sent on request.

Continental-Diamond FIBRE COMPANY

Established 1895 . . Manufacturers of Laminated Plastics since 1911—NEWARK 15 • DELAWARE

RELIABLE Connectors

Save Time

by using solderless connectors with accurately fitting precision threads which insure easy, permanent installations.

Save Copper

by using these connectors which are good as new after being salvaged.

EASY TO INSTALL
LOW IN COST

Reliable
ELECTRIC COMPANY
OVER 35 YEARS SERVICE TO THE UTILITIES

graduate of the Alabama Polytechnic Institute, he has been connected with Stone & Webster Engineering Corp., U.G.I. Contracting Co. of Philadelphia, Pa., Tennessee Valley Authority and for the past year on loan to the steam turbine section of the War Production Board. His experience has also extended into the industrial field in the construction and remodeling of gas plants, central heating plants and various industrial processing plants.

•

Engineering Appointments Announced by Weston

With post-war planning in view, announcement of changes in the engineering department of the Weston Electrical Instrument Corp., Newark, N. J., has been made by Caxton Brown, president.

John H. Miller, who has been assistant chief electrical engineer, has been promoted to chief electrical engineer. Frank X. Lamb has been made assistant chief electrical engineer. He formerly was a project engineer. Karl M. Lederer, formerly assistant chief engineer, is now assistant director of research.

J. H. Miller

W. N. Goodwin, Jr., continues as vice-president in charge of research and engineering. He relinquishes his position as chief engineer, but retains his present title of director of research. He also will be available for consultation and guidance in engineering matters in general.

Upon completing his studies at the University of Illinois, Mr. Miller took an apprentice course at the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa. After service in World War I, he joined the Jewell Electrical Instrument Co., Chicago, as chief engineer. In 1927 he was appointed vice-president and chief engineer. In 1931, shortly after the Jewell Co. was merged with the Weston Electrical Instrument Corp., Mr. Miller joined the latter organization as assistant chief engineer, six years later assuming charge of the commercial engineering division. Mr. Miller is a fellow of the American Institute of Electrical Engineers and for several terms served on the New York Section communications group committee. Along with two other engineers, he formed a Chicago section of the Institute of Radio Engineers, and served several terms as chairman and secretary of the group. He also was on the board of the Western Society of Engineers for several years. Mr. Miller is at the present time a member of the Institute of Radio Engineers.

Mr. Lamb, the new assistant chief electrical engineer, joined the Weston organization in 1921, serving in technical capacities throughout the plant until 1927, when he was transferred to the engineering department. He organized the commercial division of the engineering department in 1928 and headed this section until 1937, when he went to the Orient as resident engineer for the company. He returned in 1939, to become division chief of the engineering department, the position he held until 1942, when he was made project engineer. Mr. Lamb is a member of the A.I.E.E. and the Institute of Radio Engineers.

Mr. Lederer is a native of Munich. He received his training as an electrical engineer in universities in Europe. Mr. Lederer has been in this country almost half a century, the greater part of which time he has been with the Weston company. He has made a number of contributions in the field of measuring instruments, the more recent being the Weston ratiometer and resistor bulbs.

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▶ JAMES M. BRODBECK, district manager, Welsbach Street Lighting Co., New York, has been appointed division manager, Chicago. In his new capacity, Mr. Brodbeck will supervise in Chicago, St. Louis, and Kansas City the operations of the Welsbach Street Lighting Co., a subsidiary of the Welsbach Engineering & Management Corp. Formerly manager of industrial relations, Northern Indiana Public Service Co., Hammond, Ind., Mr. Brodbeck joined the Welsbach organization in 1938 as field representative. In 1939 he became district manager, St. Louis, and was promoted to district manager, New York, 1940. JAMES R. CAMPBELL, assistant manager, New York, has been appointed district manager, New York, to succeed Mr. Brodbeck. A graduate of Lehigh University in electrical engineering, Mr. Campbell joined the Welsbach group in 1938 as field engineer,

A LEADING COSMETICS MANUFACTURER REPORTS:

"We cut down the size of our gift boxes and standard packages to effect an over-all saving of approximately 25% of the paper and cardboard; standardized our window displays and eliminated all die-cuts, as well as steps, shelves and secondary planes. We also folded all displays in half to save more than 50% of the paper and paperboard normally used."

A BIG PLATE GLASS COMPANY REPORTS:

"Our 1944 Color Book was reduced in size and quantity, resulting in a paper saving of 136,000 pounds. Our Color Cards, of which four or five million are used annually, were reduced in size at an approximate reduction of 50% in paper tonnage. We have eliminated our Dealer Sales Portfolio. Our Color Book has become a 'self mailer,' eliminating need for envelopes."

Mr. Manufacturer,

CAN YOU TOP THESE?

The quotations used in this advertisement are from responses to the A. N. A. Committee of Paper Saving.

ONE OF THE TOP LIFE INSURANCE COMPANIES REPORTS:

"In 1944 we will continue to specify lighter weights of paper wherever possible and take all possible steps further to reduce paper tonnage. We are instructing our field offices to scrutinize carefully all requests for printed material and to disapprove all requests for quantities that appear excessive."

A FAMOUS ADDING MACHINE COMPANY REPORTS:

"In advertising and promotion we are using about 30% of the amount of printing and paper used in 1941 — that represents about 2/3 saving. However, further savings will be effected whenever possible this year as last."

Remember:

PAPER IS WAR POWER

USE LESS—SAVE ALL WASTE PAPER!

This advertisement contributed by this publication and prepared by the War Advertising Council in cooperation with the War Production Board and the Office of War Information.

STATES TESTING EQUIPMENT

FOR

RELAY

TESTING

TYPE VS

Transformer Type Load

Provides smooth loading from 0 to 90 and other "VS" Loads from 0 to 120 or 160 amperes. This Type of Load is most compact for a given capacity. Cat. 5 Sec. 1 shows the various standard sizes. Quotations on special Loads will be gladly submitted.

Ohm-spun

Resistance Loads

Control either AC or DC circuits.

Non-Inductive—provided with Rheostats for smooth adjustment.

See Cat. 5, Sec. 1 for full details.

TEAR & MAIL TODAY

to-THE STATES COMPANY
#3 New Park Ave., Hartford 6, Conn.
Please send copy of Cat. 5 Sec. 1 to

Name .....

Title .....

Firm .....

City .....

State .....

following experience with the Consolidated Edison Co., New York, and the Western Electric Co. He has been assistant manager since 1940.

▶ CARL CHRISTIANSEN has been appointed to the engineering staff of the John C. Dolph Co., Newark, N. J. He was formerly in charge of electrical construction for the Pan American Airways in the South Pacific. Previously, he was associated with Curtiss-Wright Corp., electrical division, and International Motor Co.

▶ C. A. LAPPE, for a number of years assistant secretary and assistant treasurer of the Safe Harbor Water Power Corp., Baltimore, Md., has been promoted to the position of secretary and treasurer. A. C. JENSEN, who has long been associated with the company, has been elected assistant secretary and assistant treasurer.

▶ FRANK E. BODINE, Utah and Idaho representative for the Westinghouse Electric & Manufacturing Co. since 1928 and manager of the Salt Lake City office since early 1941, has been transferred to San Francisco as manager of the company's San Francisco office. STANLEY M. JOHNS has been made manager of the Salt Lake City office to succeed Mr. Bodine. Mr. Johns served Westinghouse at Los Angeles and St. Louis, before joining a southern California utility in 1933. Returning to Westinghouse at San Francisco later, he was transferred to Salt Lake City in 1941.

▶ CHARLES L. SAUNDERS, formerly vice-president of the Minneapolis-Honeywell Regulator Co., has resigned as branch chief of the WPB Office of Civilian Requirements, to become vice-president of Wheelco Instruments Co., Chicago. Mr. Saunders joined WPB in 1942 to organize an instrument branch to correlate manufacturing problems of the instrument industry with war production. Mr. Saunders is recognized for valuable contributions to the science of instrumentation in many industries, and has specialized in oil refining processes, the ceramic industry and the metal industries.

▶ J. C. MACFARLANE, vice-president of the Canadian General Electric Co., Toronto, has been elected president of the Canadian Manufacturers' Association.

▶ F. F. SAMPSON, manager New York branch, Electric Storage Battery Co., Philadelphia, has retired after 30 years of service. DANIEL P. ORCUTT, who has been assistant manager since 1921, succeeds Mr. Sampson as manager. A graduate of Denison and Cornell Universities, Mr. Orcutt was in the engineering department of the Westinghouse Electric & Manufacturing Co. from 19[illegible] to 1910 when he joined the Electric Storage Battery Co. as sales engineer of the New York branch.

▶ R. E. ELLIOTT, formerly lighting engineer for Sylvania Electric Products Inc. in the Chicago area has recently been appointed manager of the lighting and lamp department of Hawkins Electric Co., Chicago electrical wholesale supply firm. Mr. Elliott served as lighting engineer with Benjamin Electric Mfg. Co. for eight years prior to his association with Sylvania. He is a member of the Illuminating Engineering Society and has recently been elected chairman of the Chicago section for 1944-45.

▶ DR. DONALD K. TRESSLER, manager of the General Electric Consumers Institute, has been named an honorary member of the Food and Nutrition Society of Brazil. Prof. Josue de Castro, president of the Society, announced the honor has been bestowed upon Dr. Tressler for his "valuable contributions to the science of nutrition." Dr. Tressler is well acquainted with the food and nutrition problems of Brazil, having served as a special representative of the U. S. Department of Commerce at the Brazilian Centennial Exposition, which was held in Rio de Janeiro in 1922 and 1923. At the present time he is directing frozen food research for the General Electric Co.

▶ FRANK C. ANGLE, manager of Allis-Chalmers sales activities in the Pacific Region, has been appointed manager of all Allis-Chalmers field sales offices of the general machinery division and their operations. He will continue to supervise operations of the Pacific Region. Mr. Angle was appointed manager of the Pacific Region in 1943 and placed in charge of all Allis-Chalmers sales and engineering facilities serving industries in the Pacific Coast area.

▶ BERNARD F. MCNAMEE has been appointed to head research work on electronic products and applications for Littelfuse Inc., of Chicago, Ill., and Monte, Calif. Prior to joining Littelfuse Mr. McNamee was in charge of the engineering department of Consolidated Engineering Corp., Pasadena, Calif., where he had been for several years.

▶ LAWRENCE E. MULLONEY has been appointed head of a newly organized consulting engineering department established by C. H. Sprague & Son Co., Boston, to facilitate the more efficient use of bituminous coal in power and heating plants, including closer co-operation with coal dealers and stoker manufacturers. Mr. Mulloney is an engineering graduate of the University of Main[illegible]

has lately been connected with the nsolidation Coal Co. (New York) at troit, Portsmouth, N. H., and Boston.

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OBITUARY

ank D. Mahoney

Frank D. Mahoney, president and ector of the Cuban Electric Co., a bsidiary of the American & Foreign wer Co., died in New York on gust 17 after a long illness. He was years of age.

Mr. Mahoney was born at Fond du c, Wis., and was graduated from the iversity of Wisconsin in 1910. He t worked in Charles City, Iowa, for Iowa Power & Light Co. and then utility work at Pottstown, Pa.

In 1918 he became commercial mana- for the Alabama Power Co., Bir- ngham, and in 1924 joined the West nn Power Co. as commercial mana-, subsequently becoming a vice- sident. In 1928 he joined the Elec- Bond & Share Co. of New York an executive capacity and from 1928 il 1935 he was vice-president of the erican & Foreign Power Co., Inc. had been president of the Cuban ctric Co. since 1931.

•

eorge Barker

George Barker, vice-president in rge of real estate and purchases and director of the Public Service Corp. New Jersey, died on August 23 in k Hill Falls, Pa. He was 68 years d.

Mr. Barker was born in Baltimore d went to Newark in 1898. In 1903, en the Newark Consolidated Gas Co. s amalgamated with the Public Serv- Corp., he was its secretary-treasurer. 1905 he became real estate agent the Public Service Corp. and in 25 was made a vice-president.

•

oyall A. Osborne

Loyall A. Osborne, retired vice-presi- nt of the Westinghouse Electric & nufacturing Co., whose death was nounced in ELECTRICAL WORLD, gust 26, page 10, was prominently ntified with the electrical manufac- ing industry for a number of years. A native of Newark, N. J., and a aduate of Cornell University, he nt to work in 1891 for the Newark ant of Westinghouse. He left the mpany in 1894 to engage in business his own, but returned the following ar to the main plant at East Pitts- rgh, to assist in the organization of the production department. In 1897, he was made assistant to the vice-president and in the next few years was made manager of works, fourth vice-president in charge of manufacturing and engineering and vice-president in charge of sales and engineering.

In 1915 he was transferred to New York and was placed in charge of the company's general commercial and foreign policy. He was elected president of Westinghouse Electric International when it was organized to handle the company's foreign business. He was a director of the parent company from 1924 to 1935, and retired in 1936.

•

Mortimer E. Cooley

Mortimer E. Cooley, dean of the colleges of engineering and architecture at the University of Michigan for 25 years and a member of the faculty for 47 years, died in Ann Arbor on August 25 at the age of 89. At the time of his death he was dean emeritus of the College of Engineering and Architecture.

Dr. Cooley was born in Canandaigua, N. Y., and was graduated from the United States Naval Academy. In 1881 he was detailed by the Navy Department to the University of Michigan as professor of steam engineering and iron shipbuilding, and in 1885 he resigned from the navy to accept the chair of mechanical engineering at the university. After service in the Spanish-American War he returned to the University, undertaking a large amount of important appraisal work on power plants, railroads, telegraph and telephone lines and river improvements. It was in 1894 that he became dean of the engineering college and in 1913 the deanship of the architectural college was added to his duties. He retired in 1928.

Dr. Cooley was a past-president of the American Society of Mechanical Engineers, the American Engineering Council, Society for the Promotion of Engineering Education and the Michigan Engineering Society. He held honorary degrees from the University of Michigan, Michigan Agricultural College, University of Nebraska and Armour Institute of Technology. He received the Navy Service Medal, Detroit Naval Reserve Medal and Washington Award of the Western Society of Engineers.

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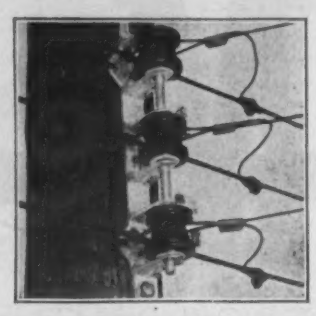
▶ ERICK A. JOHNSON, construction superintendent for the Los Angeles (Calif.) Department of Water and Power, died in Los Angeles August 8 at the age of 72.



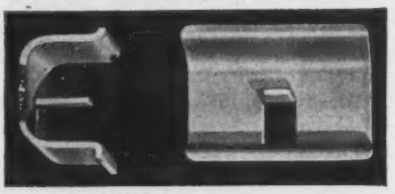
Matthews Wire Clips

It's a fallacy to think that Matthews Wire Clips are only used on guy wire to do away with the time and guy wire wasted serving above the guy clamp. For every Matthews Wire Clip sold for the purpose mentioned above 500 are sold for holding service drop wires. They save time and waste of twisting wires back on themselves. Make neater job as shown in photograph above.

The patented locking tongue shown in photograph below is inserted between the wire forming the loop and the clip is clamped tight over the insulation with pliers or wire connectors.

Thousands of Matthews Wire Clips are used in preference to serving stranded guy wire above the clamp. Save guy strand and make neater job in less time. The patented locking tongue prevents slipping. Made of galvanized iron, copper or aluminum.

Priced as low as $2.80 per 100. Write for free sample, prices and bulletin.



Aluminum, Iron or Copper

W. N. MATTHEWS CORPORATION
ST. LOUIS, U. S. A.

MANUFACTURING MARKETS

WPB Officials Cite Wire, Cable Group

Increased production of copper wire and cable during the past year despite numerous difficulties won praise for the industry from WPB officials who told a recent meeting of the industry advisory committee that it was to be "complimented on the extremely able job of production for war that has been accomplished in spite of handicaps and adverse operating conditions."

Citing the necessity for manufacturing new and little-known types of wire and cable with insufficient manpower and materials, WPB officials said the production boost "has been due to the untiring efforts of the men and women in the mills, the research and engineering departments and the managements."

Committee members suggested that specifications be reviewed with an eye toward production increases possible from a lowering of requirements, and urged curtailment of less urgent programs to release facilities for military output.

•

Sylvania Announces Design Competition

To stimulate interest in improved post-war lighting a design competition open to anyone connected with the lighting division of a public utility has been announced by Sylvania Electric Products, Inc., of Salem, Mass. A total of $1,600 in prizes will be awarded for the best designs for a shielded commercial fixture for four 40-watt fluorescent lamps.

Designs submitted will be judged by Howard M. Sharp, president of the Illuminating Engineering Society; Allan E. Parker, physics professor, Worcester Polytechnic Institute; Lurelle Guild, product design consultant; C. A. Carpenter, electrical engineer, Graham, Anderson, Probst & White. Appearance, ease of installation, maintenance, shielding and efficiency will be the principal considerations in selecting winners.

Official entry blanks, rules and complete details are available to utility lighting people on request to Sylvania Electric Products, Inc., Boston Street, Salem, Mass. Entry blanks should be postmarked not later than October 1, 1944, to cover designs submitted before December 1, 1944. Results of the competition will be announced on or before January 1, 1945.

•

Names New Representative

Trumbull Electric Mfg. Co., Plainville, Conn., has appointed Arthur H. Soper as field representative in the Philadelphia district, assisting Frank M. Oglee, manager. Mr. Soper was manager of the Philadelphia territory of the Colt's Patent Fire Arms Co. electrical division from 1926 until Colt's electrical division was recently sold.

Westinghouse Streamlines Meal Planning Course

A year 'round meal planning guide of 104 pages will spearhead the new phase of the Westinghouse electric appliance division's Health for Victory nutrition program, now used in 1,700 war plants and other organizations. The new course was inaugurated September 1.

To make the program more flexible so it can be given at any time, once a day for six days, once a week or at any desired interval, Westinghouse is packaging six lessons in a new kit and is dispensing with its monthly meal planning guides, published once a month since May, 1942. The wait for a monthly meal planning guide had previously limited presentation of the meetings to a once-a-month basis.

The paper shortage is another reason for adopting a year 'round guide, according to T. J. Newcomb, sales manager who announced the new streamlined meeting course.

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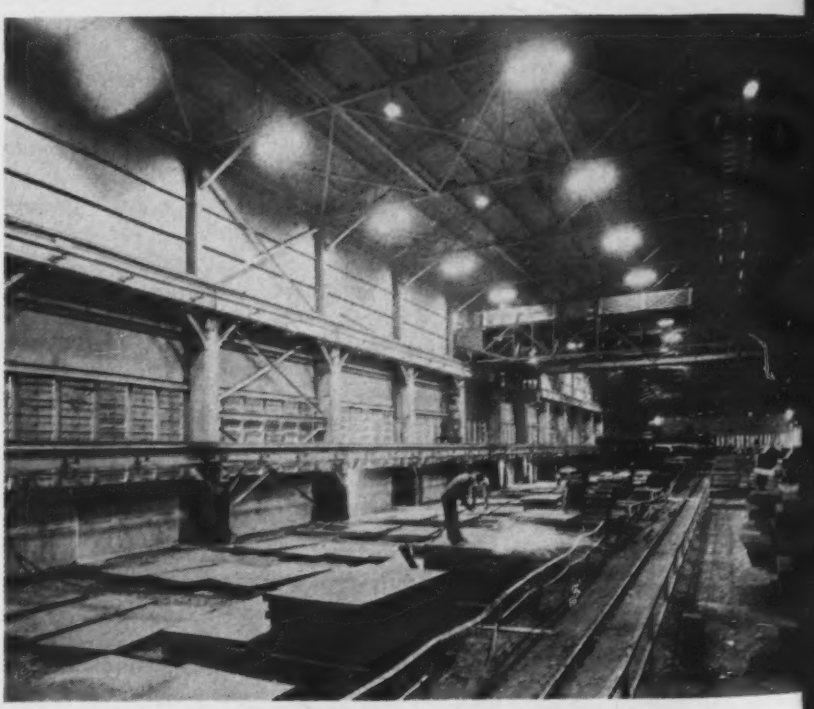
May Move to Hartford

The Electric Products Co., Newark, N. J., which recently bought assets and patents of the electric manufacturing division of the Colt's Patent Fire Arms Manufacturing Co., Hartford, Conn.,



GOOD LIGHTING MEANS BETTER WORK—The scarfer in the foreground is removing imperfections from the slab before it is sent to the plate mill. The strong, clear light needed for the work is furnished by Westinghouse 3-kw. mercury tubes in open-end porcelain enameled reflectors. Color correction in this inspection area is obtained through the use of 1,000-watt incandescent lamps in Westinghouse Millite fixtures. Thirty type AH-9 mercury lighting units, mounted in two parallel rows 42 feet above the floor and 28 feet apart, furnish average illumination of 50 foot-candles on the working plane below

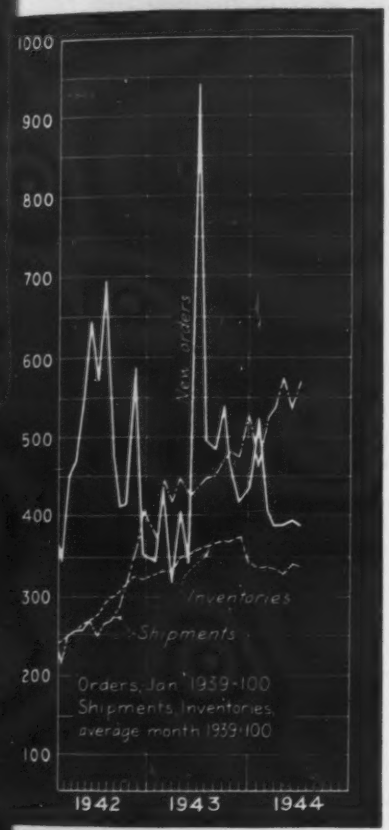
nsidering plans to move its entire siness to Hartford. How soon this ay be accomplished has not been de- ded.

The electrical division of Colt's is now cated in a plant formerly occupied by e Hartford Rubber Co.

•

une Machinery Orders Show Slight Drop

Only a slight drop in the value of ew orders received by manufacturers electrical machinery occurred during e month of June, according to figures eleased by the Bureau of Foreign and omestic Commerce. The index com- iled by the bureau dipped to 388 from 95 (revised) in May. This compares ith 943 for the month of June, 1943.



LECTRICAL MACHINERY INDICES of ureau of Foreign and Domestic Commerce

The index, covering shipments of lectrical machinery, regained in June ost of the ground it had lost the pre- ding month when it dropped to 538 revised) from 576 in April. In June reached the 570 mark, as compared ith 436 in the corresponding month ast year.

Changes in the value of inventories f the electrical machinery industry ere not large in June, the index com- iled by the bureau moving slightly ownward to 338.9 from 341.2 (re- ised) in May. It stood at 358.5 in une, 1943.

MAILING LISTS THAT WORK . . .

McGraw-Hill Industrial Mailing Lists are a direct route to today's purchase-controlling executives and technicians in practically every major industry.

These names are of particular value now when most manufacturers are experiencing constantly increasing difficulty in maintaining their own lists.

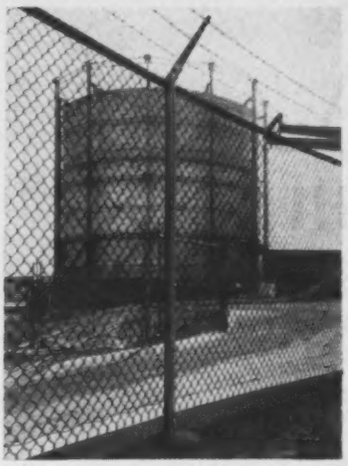
Probably no other organization is as well equipped as McGraw-Hill to solve the complicated problem of list maintenance during this period of unparalleled changes in industrial personnel. These lists are compiled from exclusive sources, based on hundreds of thousands of mail questionnaires and the reports of a nation-wide field staff, and are maintained on a twenty-four hour basis.

Investigate their tremendous possibilities in relation to your own product or service. Your specifications are our guide in recommending the particular McGraw-Hill lists that best cover your market. When planning your industrial advertising and sales promotional activities, ask for more facts or, better still, write today. No obligation, of course.

McGraw-Hill Publishing Co., Inc.
DIRECT MAIL DIVISION
330 West 42nd Street **New York, 18, N. Y.**

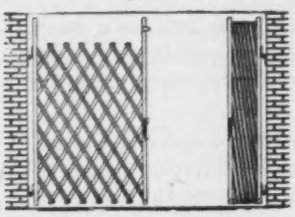
Stewart IRON and WIRE FENCES

Metal restrictions have been modified to permit the manufacture and sale of Chain Link Wire Fence, Folding Gates, Window Guards and Wire Mesh Partitions for certain industrial uses. You may be able to qualify. So tell us what you need and we will advise as to priority procedure.



Typical Stewart 3TH Chain Link Wire Fence Installation

STEEL FOLDING GATES



Furnished in single or double gate construction. When requesting prices send sketch indicating width and height of opening.

WIRE MESH PARTITIONS and WIRE WINDOW GUARDS

Partitions are effectively used for stock rooms, supply rooms, locker rooms, etc. For prices, send sketch indicating lineal footage, arrangement of doors, pass-out windows, etc. Window Guards are furnished any size, any shape. Made with ¾" or ½" round frame or ¾" to 1" channel frame. When writing for prices, indicate width and height of openings. Also state anchorage conditions.

THE STEWART IRON WORKS CO., Inc.
1101 Stewart Block
CINCINNATI 1, OHIO

Field Reports on Business

Recent reports indicate that, while war production as a whole is being well maintained, serious shortages are developing at certain points. Inquiries for 1946 deliveries of electrical equipment are increasing. The demand for line materials, control apparatus for post-war delivery is active.

NEW ENGLAND

Inquiries for 1946 deliveries of electrical equipment are increasing. Modernization of vacant stores in Boston's retail district is moving ahead; work is being pushed on the completion of New England airports in anticipation of post-war booms in air travel, and bidding on naval electrical requirements is active.

The demand for line materials, hardware, and control apparatus for post-war delivery is increasing according to one distributor. Wiring supplies subject to priorities are moving in fairly good sized quantities. MacFarlane & Sons, Inc., Boston, have a contract to re-wire the ballroom and foyer of the Copley Plaza Hotel in that city. Improved line facilities, including both overhead and cable sections are under construction in connection with the supply of electricity from Hartford to Manchester and Glastonbury, Conn., at 22 kv. instead of 11 kv. United States Rubber Co. is opening a new plant in Keene, N. H., in the near future which will employ between 100 and 200 workers and will be used for the manufacture of war materials. Filene's Television Inc., has applied to the Federal Communications Commission for permission to construct a new FM broadcast station in Boston to be operated on 43,100 kilocycles.

Small switches, insulating material, friction tape, electric hot plates, and radio accessories are being purchased at a steady rate by the Navy. A Massachusetts company has submitted a bid to furnish 1,800 radio head sets; other bids noted include small motor-generator sets, copper and bronze tubing, and panel board supplies. Bidding was active on more than $100,000 worth of friction tape for the Navy and on large lots of alarm system supplies.

PACIFIC COAST

Total value of building permits in the 7 western states for July, 1944, shows a 10% increase over July last year mainly because of California's 50 percent increase which offset a 60 percent decrease in the Northwest.

Kaiser's application for $3,500,000 for remodeling 4,300 housing units in Vancouver, Wash., has been cut to $1,600,000 by FHA, with a considerable portion intended for refrigerators, ranges, and other electrical appliances. WPB has approved a 54-mile 230 kv. extension of Bonneville system from Columbia to Vernita substation, together with its switching facilities at Columbia and Midway for a total estimated cost of $2,670,000, so as to increase substantially Bonneville power deliveries in Portland and Seattle regions.

Orders include $30,000 of traction motors and cable for a railroad; $20,000 of controls for a Navy post office; a $90,689 award for pumping plant at Tule Lake, Calif., as part of Kalamath project; a $38,432 low bid for 161 kv. switchyard steel for Phoenix substation and parker powerhouse. New major government construction includes $6,000,000 for a power station and storehouses for Pocatello, Idaho, Naval ordnance plant.

NEW YORK

The net working capital of American co[r]porations reached a new high in the fi[rst] quarter of this year, estimated at $4[2] billion as of March 31, 1944, according [to] the quarterly analysis made by the Secu[ri]ties and Exchange Commission.

Civil engineering construction volume [in] continental U. S. last week totaled $3[7] 309,000. This volume was 12 percent low[er] than a week ago and 8 percent lower th[an] in the corresponding 1943 week, accordi[ng] to *Engineering News-Record*. Private wo[rk] gained 84 percent over the preceding wee[k] but was 53 percent below a year ago. Pu[b]lic construction reported a 19 percent d[e]crease from last week, while gaining [a] percent over last year. The week's co[n]struction brought 1944 volume to $1,20[1] 360,000 for the 34 weeks, a decrease of [4] percent from the $2,224,088,000 report[ed] for the 1943 period.

Cooler weather spurred interest in fa[ll] merchandise last week, with departme[nt] stores sales increasing 22 percent over th[e] corresponding week last year, according [to] the Federal Reserve Bank of New York.

CHICAGO

Utility inventories in the Chicago are[a] and the nation as a whole are currentl[y] reported at about the level of the late 194[0]. Indications are that OWU now considers it no longer necessary to maintain clo[se] control of utility purchases to force utiliza[-]tion of inventories, and will soon revi[se] order U-1 to eliminate the need for direc[-]ing inquiries to OWU regional utility en[-]gineers regarding available material in ex[-]cess inventories of other companies.

For the past several months from a mi[l]lion to a million and a half pounds of co[n]ductor per month have been drawn fro[m] excess inventories of utilities in this area t[o] meet construction needs here and elsewher[e]. It is further reported that more than ha[lf] the inquiries directed to the regional offi[ce] of OWU have been filled from available surplus stocks of companies in the area.

Necessary expansion of municipal, pr[i]vate and REA power systems in the are[a] continues on a very gradually increasing scale. A new 1,000 kva. substation ha[s] recently been approved by WPB for th[e] Barron REA cooperative in Wisconsin [and] has also a substation of undisclosed siz[e] for the Bayfield REA cooperative of th[e] same state. In South Dakota, Northwestern Public Service Co., Huron, has secured [a] priority rating for expansion of a steam[-] electric generating station to include in[-]stallation of a new 7,500 kw. turbo-gener[-]ator, boiler and auxiliary equipment. Ok[-]lahoma Gas & Electric Co. plans extensio[n] of transmission lines some 15 miles and the erection of terminal substations. De[-]troit's Public Lighting Commission ha[s] been authorized by the city council to ar[-]range for improvement of the municipal lighting system to the amount of $750,000. In Iowa the municipal lighting department of Sumner has advertised for bids on ex[-]pansion of its power plant including addi[-]tion of a 1,000 hp. diesel engine generator switchgear and wiring.

Sales Opportunities

NORTH DAKOTA—Otter Tail Power Co., Fergus Falls, Minn., plans new transmission line, close to 60 miles, to connect power station with main transmission system. Application has been made for permission and work is scheduled to begin as soon as secured.

UTAH—Garfield Chemical & Mfg. Co., a unit interest of Utah Copper Co., and American Smelting & Refining Co., McCormick Bldg., Salt Lake City, has plans maturing for new plant for production of sulfuric acid. It will consist of several large units, with machinery and electrical equipment for initial capacity of about 150 tons per day. A power house is planned. Cost estimated close to $1,000,000. Project has a priority rating.

TENNESSEE—Construction Service, Veterans' Administration, Washington, D. C., has plans nearing completion and will take bids soon for additional buildings at institution, comprising several large units, with electrical and mechanical equipment and facilities. Also, will make extensions in outside electrical distribution lines and services, including underground conduit system; ventilating apparatus and accessories. An addition will be made to boiler house, with installation of equipment for increased capacity. No estimate of cost announced.

INDIANA—Board of Trustees, State School for Feeble-Minded, Fort Wayne, plans postwar expansion program at institution, to cost in excess of $1,500,000. Work will include expansion in power plant, with installation of additional equipment, reported to cost close to $200,000; also, extensions in boiler room, with installation of new 750-hp. boiler and accessories, estimated at $105,000. An addition is planned to cold storage plant, to cost approximately $60,000, with equipment. A. M. Strauss, Cal-Wayne Bldg., Fort Wayne, architect, will make surveys and plans.

WASHINGTON—Bureau of Reclamation, Denver, Colo., will receive bids until September 19, for one miter gate operating mechanism, consisting of two operating units for installation on drydock, Grand Coulee Dam, Columbia Basin project (Specifications 1764-D); until September 20 for caisson hoists, barge hoists and auxiliary hoists for maintenance of spillway bucket, same project (Specifications 1763-D). All equipment will be installed by government.

NEBRASKA—Loup River Public Power District, Columbus, has plans under way for extensions in primary and secondary lines in different parts of District territory, including power substations and other operating facilities to serve large group of additional consumers. Cost reported close to $1,000,000. Proposed to begin work late this year or early in 1945.

IOWA—Power and Light Department, Pella, will receive bids until September 19 for new coal-handling system at municipal power plant, including track hopper, coal crusher, skip hoist or bucket elevator, coal bunker and complete auxiliary equipment. No estimate of cost announced. Brown Engineering Co., Valley Bank Bldg., Des Moines, is consulting engineer.

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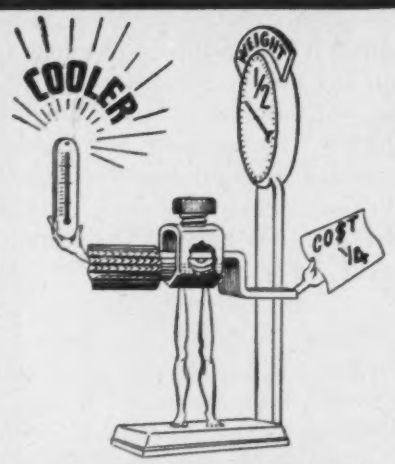

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MASSACHUSETTS—Panther-Panco Rubber Co., Inc., 31 Highland St., Chelsea, manufacturer of soles and heels, will construct and operate new branch mill, consisting of several one-story buildings, with machinery and electrical equipment for large capacity. Cost reported about $1,000,000, with financing by Defense Plant Corp. Work will be carried out soon.

FLORIDA—Department of Public Safety, City Hall, D. D. Rosenfelder, director, plans installation of motor-driven pumping machinery, controls and auxiliary equipment in proposed new high-pressure pumping plant for fire protection system, to be carried out as a post-war project. Cost estimated about $125,000. Also will make extensions and improvements in police and fire alarm systems in different parts of city, comprising part of a $1,600,000 program for these departments.

MONTANA—Bureau of Reclamation, Denver, Colo., will receive bids until September 12 for two steel towers for river crossing for 115-kv. transmission line from Fort Peck hydroelectric power plant to Glendive. Also for Glendive substation structures, Fort Peck project. Construction will be carried out by government (Specifications 1760-D).

VIRGINIA—General Chemical Co., Inc., 40 Rector St., New York, N. Y., has completed plans for proposed new plant on part of 75-acre tract of land, recently acquired, and will begin work on initial buildings at early date. It will comprise several one and multi-story structures for sulfuric acid production, with machinery and electrical equipment for large capacity. A boiler plant will be built, with power substation for central station service for mill operations. Entire project is estimated to cost about $1,500,000, with financing by Defense Plant Corp.

NORTH CAROLINA—Tide Water Power Co., Wilmington, has contracted with Bureau of Yards and Docks, Navy Department, Washington, D. C., for furnishing power supply at Camp Lejeune, and will make line extensions and install facilities for light and power service.

UTAH—Municipal Electric Light Department, Logan, has plans under way for expansion in diesel-electric generating station, including installation of additional diesel engine-generating unit, and auxiliary equipment. Cost estimated close to $200,000. It is understood that project will have a priority rating. E. J. Moser, Logan, is consulting engineer.

TEXAS—Bureau of Reclamation, Denver, Colo., will receive bids until September 11 for one 16-ton hoist elevator, including motor-driven pumping unit, with electrical controls, wiring, etc., for Marshall Ford dam, Colorado River project. Equipment will be installed by government (Specifications 1761-D).

ILLINOIS—Harlich Mfg. Co., Inc., 1417 West Jackson Blvd., Chicago, manufacturer of paper products, plans new one-story converting plant on site, 300 x 715 ft., at Homan Ave. and Division St., recently acquired, with machinery and electrical equipment for large capacity. Project will be carried out as a post-war development and is estimated to cost approximately $2,000,000, of which about one-half will be used for equipment installation. A. Epstein, 2001 West Pershing Rd., Chicago, is engineer.

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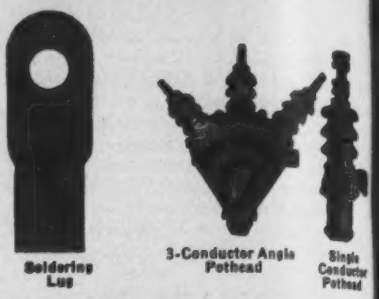

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New REA Allotments Total $1,021,000

Rural Electrification Administration has recently made loan allotments totaling $1,021,000 to 13 rural cooperatives in ten states.

Three of these loans will provide for the construction of refrigerated locker plants with slaughtering, food processing and storage facilities. The other funds will be used mainly for the extension of electric service to farms which can make a substantial contribution toward increased food production. No construction will be undertaken which does not meet WPB regulations.

This brings REA allotments to $503,226,301, of which $4,346,000 represents operations during the current fiscal year.

Individual loans are listed below. Those not otherwise described will be used for service extensions.

ALABAMA—Southern Pine Refrigeration Coop., Brewton, $25,000 for locker plant.

ARKANSAS—Mississippi County Electric Coop., Inc., Blytheville, $240,000.

INDIANA—Dubois Rural Electric Coop., Inc., Jasper, $50,000. Harrison County REMC, Corydon, $75,000.

KANSAS—Flint Hill Rural Electric Coop. Assn., Inc., Council Grove, $100,000.

KENTUCKY—Clark Rural Electric Coop. Corp., Winchester, $25,000.

LOUISIANA—Jefferson Davis Electric Coop., Inc., Jennings, $151,000 for farm connections and for the installation of substation equipment.

MICHIGAN—O & A Electric Coop., Newaygo, $60,000 for purchase and installation of generating facilities and substation equipment.

MISSOURI—Atchison-Holt Electric Coop., Rockport, $50,000. Mt. Vernon Electric Refrigeration Coop., Inc., Mt. Vernon, $28,000 for locker plant.

NORTH CAROLINA—Randolph Elec. Membership Corp., Asheboro, $60,000.

TEXAS—Coleman County Elec. Coop., Inc., Coleman, $100,000 for farm connections and for necessary line equipment. Brazos Valley Refrigeration Coop., Inc., Bellville, $57,000 for locker plant.

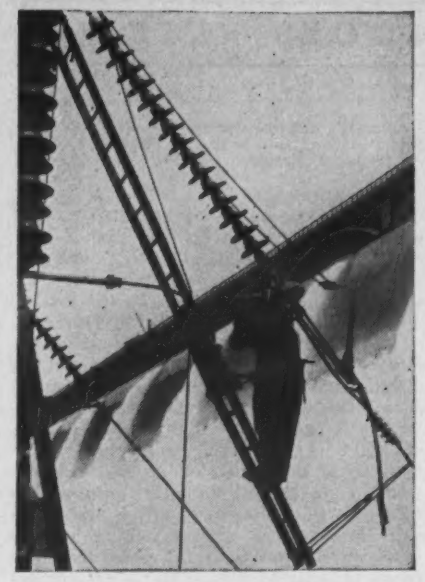
•

Revised Terminal Marking Standards Book Published

The fourth revision of the "American Standard, Terminal Markings for Electrical Apparatus" has been released by the American Standards Association.

Additions in the revision include markings for capacitor motors and their many auxiliary devices and leads; new markings for resistors, brakes and starting reactors; and a new section on water heaters. In this latter section, color is used for the first time in the book as a means of identifying the wiring for the water heaters and associated devices.

The book is on sale at the New York office of the association, 29 W. 39th St.



Pictured above is a lineman Ned Ingalls who, with the aid of a Coffing "Safety-Pull" hoist, is man-handling a soon-to-be "hot" wire, as he imitates the "man on the flying trapeze" from his dizzy perch at Grand Coulee Dam.

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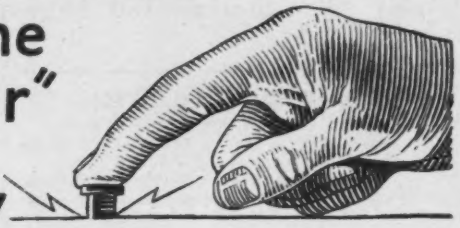

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Professor of Economics, University of Wisconsin

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BOOKS RECEIVED

Automatic Control Engineering. By Ed Sinclair Smith. McGraw-Hill Book Co., New York, N. Y. 367 pages, illustrated. Price $4.

Automatic control of industrial operations and processes has lacked a single text which could give the art the impetus of a coordinated mathematical tooling. This the author has definitely provided because it was his aim and achievement to muster the pertinent physics, mechanics, hydraulic, electrical and mathematical implements rather than to describe the workings and applications of the extant control mechanisms. As a result there can be more of direct, objective design in automatic control and less of the ingenuity and empiricism which marked the beginnings of the art. The electrical engineer will find considerably less difficulty in following Smith's technique than engineers of other schooling because most of the relationships assembled are those familiar to him. This is natural because the phenomena and impediments in automatic control (lag, retardation, hunting, attenuation transients, phase angles, etc.) have their counterparts in the field of electrical engineering for which there has been evolved the needed analytical procedures.

Arc and Acetylene Welding. By Harry Kerwin. Published by McGraw-Hill Book Co., New York, 240 pages, illustrated. Price $2.50.

Asserting that arc welding can be mastered better by first learning the technique of acetylene welding the author first describes the acetylene equipment and then sets down 27 progressive lessons in plate, aircraft and pipe welding. Each step is given in minute detail with as much emphasis on things not to do as on those to do to achieve the requisite 110 percent weld. After discussing cutting, hard facing, alloy welding and brazing, the treatment proceeds to add 14 graded lessons on arc welding. It is a strictly non-theoretical book aimed at perfecting the handiwork of good weld execution. Designed for the vocational class it seems equally instructive for the utility repair worker on his own, particularly if he has acquired some false notions and bad habits of technique.

Basic Mathematics for Engineers. By Paul G. Andres, Hugh J. Miser and Haim Reingold. John Wiley & Sons, Inc., New York, N. Y. and Chapman & Hall, Ltd., London. 726 pages, illustrated. Price $4.

Picking up where the high school sophomore will have reached, this book presents algebraic equations and graphed functions, trigonometry, vectors, logarithms, determinants, higher algebra, analytic geometry and the elements of differential and integral calculus. The treatment draws wholly upon engineering for illustrative exercises. It has really in one volume for engineers everything significant below calculus.

Principles of Powder Metallurgy. By Franz Skaupy. Philosophical Library, New York, N. Y. 80 pages, illustrated. Price $3.

A translation of the author's treatise on synthetic metal bodies (sintered, fritted or pressed) dealing with the preparation and properties of the powder, control of grain size and the processes of combining and compacting the powder bodies, with or without binding agent. Closure deals with the "ceramics" of tungsten, molybdenum, tantalum and hard metals generally.

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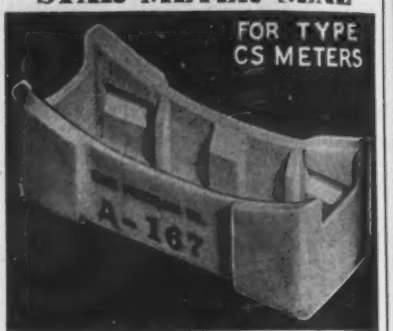

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LETTERS TO THE EDITOR

Fungus Growth on Insulation

To the Editor of ELECTRICAL WORLD:

You asked for information for a reader concerning "the precise effects of fungus growths on electrical insulations, particularly varnished, saturated and non-saturated sleevings, what forms these growths take and their origin."

Most folks are disturbed at this problem because they realize that it would take quite a long time to find out just what are the effects and rather than use up time to find the answer to this question, they cut short corners and proceed to see what they can do to prevent the growth of fungus and, if they do, they will automatically eliminate any effects which fungus might produce. It is known that fungus will consume a lot of different kinds of electrical insulation including varnish coatings, phenolic laminated products, cotton and paper. Some of these plants even go so far as to grow on a dust film which may be deposited on a glass surface. Some of these plants in their growth and during their metabolism exude something, ossibly very acidic, which eats holes in glass, and, I understand, will even eat holes in metals. From this information I think we can fairly safely draw the conclusion that fungus growth will impair not only the electrical properties of an insulation but also its physical properties. Of course, even though fungus growth may not be present, the warm and extremely humid atmosphere in which fungus does occur would undoubtedly cause unfavorable changes in nearly all electrical insulation. So while the engineer is giving attention to innoculating his insulation against fungus growth, he must also give attention to improving the moisture resistance of his insulation in order that it may function reasonably satisfactorily in tropical regions where fungus growth flourishes.

As regard to the forms of these plants, I would say that most of those which I have seen grow in a two dimension direction and very little in the third dimension. In other words, these are flat plants growing close to the surface, although some of them do grow long wooly whiskers, and unless you keep an eye on your bread box in the summertime even in the New York area you can sometimes find these long wooly whiskers on an old piece of bread. Of course, the fellow who is fond of his Roquefort Cheese knows what that fungus looks like and he knows even what it tastes like. I believe this fungus is called Penicillium Roquefort, although there seems to be some dispute even here because I find one fairly good authority on fungus say that the green in the cheese is the fungus Aspergillus Glaucu

Spores seem to be present in almost microscopic particles floating in the air. They are certainly very abundant in the soil. The most virulent type, of course, is found in the tropic regions.

It appears that a demand has developed for a crossbreed in the professional line. The individual to carry on studies of this kind needs to be a cross between a chemist, electrical engineer and bacteriologist. Men of these different trainings are now working on the problem and this also will be solved.

C. F. Hanson
Chief Consulting Engineer
Irvington Varnish and Insulator Co.

•

Liquid in Fuse Shell

To the Editor of ELECTRICAL WORLD:

The item "Inexpensive Interruptor Replaces OCB" in the ELECTRICAL WORLD of May 13, 1944 (page 114) carries the phrase "a loading rod is inserted into the liquidless fuse shell." This is incorrect, as the shell contains the usual amount of tetra-chlor-ethylene.

I might mention that we have not tried these interruptors without liquid —I fancy the results would be more spectacular than effective. If this letter does not reach you in time to correct the extract, then perhaps you will follow it with this explanation of the error in a later issue or else your readers may credit us with more enthusiasm and imagination than ingenuity and veracity.

In every respect the device is the same as a liquid fuse except that it is operated by a trigger instead of fusing the strain wire. The interrupting capacity is, therefore, comparable with that of the corresponding liquid fuse. We have used the device to isolate 33 kv. line up to 110 miles in length, at times of light load and also to interrupt the exciting current of 2,500-kva., 33-kv. transformers.

Thank you for your complimentary remarks on our publication which are heartily reciprocated.

William Patterson
Editor of "Adelect"
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SELL MORE THAN BEFORE!

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PRODUCTION ENGINEER — fractional h.p. electric motors. Should have specialty background in single phase motors, having devoted major effort to efficient mass production. Line will have limited size range. Engineering design experience desirable for development of motors for tooling and production. Permanent connection with outstanding Southern California manufacturer entering household appliance field. Send detail of experience and personal qualifications to A.W.A., Box 68, Station K, Los Angeles, California.

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ELECTRICAL AND HYDRAULIC engineers experienced in design and construction. Permanent positions open in Wisconsin. Essential, with excellent postwar prospects. Applications from demobilized servicemen welcome. Send details of age, education, experience, draft status, availability, and salary expected. P-736, Electrical World, 520 N. Michigan Ave., Chicago 11, Ill.

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Enka, North Carolina

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D.L.R.—Employment Dept.

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Electrical engineer wanted who is experienced in industrial plant design to work in mechanical engineering and drafting office of a manufacturer of electrical conductors located in New York State.

P-722, Electrical World
330 W. 42nd St., New York 18, N. Y.

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For electrical equipment manufacturer; one who can coordinate the flow of materials and parts, manufacture and assembly, to secure maximum production. Must understand efficient operation and be a good labor-relations man.

P-724, Electrical World
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OPERATING SUPERINTENDENT, twenty-five years experience in construction and operation of transmission and distribution systems. Engineering background, good customer relations, capable of training inexperienced employees. Prefer small utility or rural Co-op. PW-737, Electrical World, 520 N. Michigan Ave., Chicago 11, Ill.

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ENGINEER, 43, married, degree, private and public electric utility experience in design, construction, and management. Desires management position with utility or engineering with manufacturer with minimum travel. Salary $6,000 minimum. PW-726, Electrical World, 330 W. 42nd St., New York 18, N. Y.

ELECTRICAL ENGINEER, with twenty years experience at utility and industrial substation and power plant electrical design, construction and maintenance work, desires to make change. Will go anywhere. Cannot consider temporary position. PW-738, Electrical World, 520 N. Michigan Ave., Chicago 11, Ill.

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POSITIONS WANTED

ELECTRICAL ENGINEER, graduate 1923, responsible executive, thoroughly experienced in United States and Canada in management and operation electric utility, engineering and construction, particularly distribution, transmission and hydro plants, desires engineering or managerial position public utility or allied industry. Available in Canada, upon reasonable notice under section Wartime Bureau of Technical personnel. PW-729, Electrical World, 330 W. 42nd St., New York 18, N. Y.

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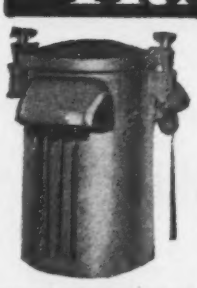

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	HP	Make	Type	Volts	Speed
2—	1250	G.E.	MPC	550	130
1—	1200	Whse.	Compen.	550	600/720
1—	800	G.E.	MPC	600	600
2—	625	G.E.	MPC	600	130
1—	600	G.E.	MPC	600	650/900
1—	500	G.E.	MPC	230	900
1—	500	Whse.	Compen.	250	840/720
1—	350	G.E.	MPC	220	450
1—	300	G.E.	DMC	230	400/600
1—	300	G.E.	MPC	230	275/550
1—	250	G.E.	C	230	375
1—	250	Al. Ch.		230	525
1—	200	Whse.		230	400
2—	175	Whse.	SK	250	150/525
1—	150	G.E.	MPC	230	250/450
1—	130	Cr. Wh.	CMC-65H	550	1200
1—	130	Whse.	SK-185	110	450/1340
1—	125	G.E.	CO-1832	230	525
1—	100	G.E.	LC-50	230	1200
1—	100	G.E.	MPC	230	225/450
1—	100	G.E.	RC-38	230	500
1—	75/100	Whse.	SK-183	230	450/900
1—	75	G.E.	LC	230	500/1000
1—	75	Whse.	SK-183	230	560/1100
1—	60	El. Dy.	258	230	525/1050
2—	50/60	Cr. Wh.	65H	230	500/1000
1—	50	Cr. Wh.	CMC-81H	230	300/900
1—	50	G.E.	RC-19	230	400/1200

TRANSFORMERS

	KVA	Make	PH Type	Voltage
6—	1667	Pitts.	1 OISC	13200x2300
1—	1050	G.E.	3 WCTH	11000x445
1—	600	G.E.	3 HT-OISC	11550x2200
1—	333	Moloney	1 C-OISC	22000/11000x2300/575
1—	333	Whse.	1 OISC	2300x460
1—	333	Pitts.	1 OISC	2400x220
1—	300	G.E.	1 H-RP	13200x575/1150/2300
1—	300	Pitts.	3 ODSC	4150x208/120
1—	300	Packard	1 OISC	2200x220/440
1—	200	G.E.	1 H-IDD	26400x115/460

MOTOR GENERATOR SETS

3 ph. 60 cycle

1—1500 KW GE 275 V. Gen. d.c. to 2100 HP 2300 V.
1—1500 KW Whse 250 v DC to 2100 HP 4400/2200 v.
1—1000 KW Whse 600 V. Gen. d.c. to 1400 HP 4000 V.
1—1000 KW G. E. 250 V. DC to 1400 HP—2300 V.
1—500 KW G. E. 250 V. DC to 700 HP—440/2200 V.
1—500 KW GE 600 V. DC Gen. d.c. to 700 HP—2200/13200 V. Syn. Motor with Exciter.
1—350 KW G. E. 220 v AC Gen. d.c. to 500 HP 250 v DC motor.
1—250 KW G. E. 250 V. DC to 375 HP—440 V.
1—300 KW G. E. 250 V. DC to 400 KVA—2300
1—75 KW G. E. 125 V. Gen. to 120 HP IK 400/2300
1—50 KW GE 125 V. Gen. to 75 HP KT 4000/2300 V.
1—35 KW Whse 125 V. DC to 53 HP—440/2200 V.
1—25 KW G. E. 250 V. DC to 40 HP—220 V.

TURBO GENERATOR SET

1—500 KW, Whse. 625 Kva., 440 V., 3 ph., 60 cy., 3600 RPM with Parsons 145/175 lb. condensing turbine complete with jet condenser and accessories.

ROTARY CONVERTERS

60 cycle

	KW	Make	Speed	D.C. Volt	Trans. Volts
1—	1500	Whse.	720	600	2300
1—	1500	Whse.	600	600	11500
1—	1250	G.E.	720	250	2300
1—	1000	G.E.	900	600	13200
1—	1000	Whse.	600	250	22000
1—	1000	Whse.	900	600	11000
1—	750	G.E.	1200	600	2300
1—	750	Whse.	720	250	6600/2300
1—	500	Whse.	1200	600	13200/2300
1—	375	G.E.	1200	250	6600/2300
2—	300	G.E.	1200	600	2300

25 cycle

2—	1500	G.E.	500	225/275	13200/6600
1—	500	G.E.	750	225/275	13200/6600

All units can be furnished with AC and DC controls.

A. C. MOTORS

3 ph. 60 cycle

Synchronous

	HP	Make	Type	Volts	Speed
2—	2100	G.E.	ATI	2300/4600	514
1—	600	Al. Ch.		2200	720
1—	400	G.E.	TS-7647	2300	720
1—	300	G.E.	ATI	440	600
1—	150	Whse.		4000	1800
1—	225	G.E.	ATI	240	600
1—	100	Whse.	G	2200	1800
1—	75	G.E.	TS-7556	220/440	600

Slip Ring

1—	1200	Cr.-Wh.	801-Q	2200	237
2—	1000	Whse.	CW	2300	720
1—	800	Whse.	CW	440	357
1—	800	Al. Ch.		440	885
2—	600	G.E.	IP	440/2200	720
1—	450	Whse.	CW	2200	876
1—	400	G.E.	IP	440/2200	600
1—	400	Al. Ch.		2300	505
1—	300	G.E.	IM	2300/4000	257
1—	300	Whse.	CW	440	585
1—	300	G.E.	IM	440	720
1—	250	G.E.	MT	4000/2300	257
1—	200	Whse.	CW	2200	514
1—	200	G.E.	IM	440	600
1—	150	Whse.	CW-772C	2200	1160
1—	150	G.E.	IM-17	2200	435

Squirrel Cage

1—	500	G.E.	1-17B	2200	695
1—	300	Whse.	CS	550	580
1—	300	G.E.	IK	2300	600
1—	175/112	G.E.	IK	440	900/720
1—	125	Whse.	CS	220/550	1150

SYNCHRONOUS CONDENSERS

1—	1000	G.E.	ATI	2200/3800	900
1—	900	G.E.	ATI	2200/6600	1200
1—	750	G.E.	ATI	220/440	900

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1000 KW, 460 volts, 3 phase, 25 cycle,
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1400 HP 460 volts, 3 phase, 60 cycle,
300 RPM General Electric, 1570 ampere,
1250 KVA p.f. 0.9, 50-deg. type ATI-24-1250M-300 form C, with amortisseur winding.

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N. Y. C. Tel.: LOngacre 5-3227—N. J. Tel.: UNion 3-2600

MOTORS

3 PHASE 60 CYCLE

1—500 HP, 900 RPM, 440 volt, Lincoln slip ring
1—350 HP, 300 RPM, 440 volt, G.E. slip ring
1—300 HP, 720 RPM, 2200 volt, G.E. slip ring
1—250 HP, 600 RPM, 4000 volt, G.E. sync.
1—200 HP, 600 RPM, 2200 volt, G.E., sl. rg.
1—200 HP, 450 RPM, 2200/4000 v. G.E. sl. rg.
1—150 HP, 1800 RPM, 440 volts, G.E. sq. cg.
2—150 HP, 1200 RPM, Westinghouse, squirrel cage
1—150 HP, 900 RPM, 440 volt, Al. Ch. sl. rg.
2— 75 HP, 1200 RPM, 2300 volt, G.E. vertical

D. C. 230 VOLTS

2—450 HP, 400 RPM, General Electric MPL.
1—250 HP, 760 RPM, Electro Dynamic.
2—150 HP, 550 RPM, Westinghouse, SK.
1—150 HP, 750 RPM, Electro Dynamic.
1—125 HP, 600 RPM, Westinghouse, SK.
1—100 HP, 625 RPM, G.E.
1— 80 HP, Crocker-Wheeler, 600 RPM.
1— 75 HP, 950 RPM, General Electric
1— 50 HP, RPM, Westinghouse, type SK.

VARIABLE SPEED 230 VOLTS

1—90 HP, 470/940 RPM, General Electric.
1—75 HP, 525/1575 RPM, Electric Dynamic.
1—35 HP, 500/1500 RPM, Westinghouse.
1—35 HP, 350/1050 RPM, Electric Dynamic.
1—30 HP, 225/900 RPM, Crocker-Wheeler.
1—30 HP, 400/1200 RPM, General Electric
2—25 HP, 300/900 RPM, Electro Dynamic.
1—20 HP, 750/1500 RPM, General Electric.
1—13/18 HP, 350/1200 RPM, Electro Dynamic.
1—5 HP, 600/1200 RPM, General Electric.
1—5 HP, 450/1800 RPM, Crocker-Wheeler.

MOTOR GENERATOR SETS

1—750 KW, 250 volt, Allis-Chalmers, synchronous.
1— 75 KW, 125 volt, General Electric, squirrel cage.

TRANSFORMERS

2—400 KVA, G.E. 4156-240/480 v. Scott taps.
2—300 KVA, Pittsburgh, 7800/440 volts.
3—200 KVA, Allis-Chalmers, 2200/220/440 volts
3—150 KVA, G.E., 33,000 2300/4000 Y.
4—150 KVA, G.E. 2400/240/480
3—100 KVA, Westinghouse, 11,430/250 volts.
1—100 KVA, Pittsburgh, 1375/2750-110/220 volts.
3—100 KVA, Westinghouse, 13200 250 volts.
3—100 KVA, Allis-Chalmers, 2200/220/110
3— 75 KVA, General Electric 2200/220/440.

ALTERNATORS

1—625 KVA, 3600 RPM, 600 volt, G.E.
1—250 KVA, 720 RPM, 230 volt, G.E.
1—225 KVA, 514 RPM, 600 volt, Westinghouse.
1—200 KVA, 3600 RPM, 240 volt, Allis-Chalmers.
1—62½ KVA, 3600 RPM, 220 volt, Allis-Chalmers.

ENGINE GENERATOR SETS

600 KW, Terry dual bleeder condensing Turbine only.
1—500 KW, G.E., 3 ph., 60 cy., 480 volt, bleeder.
1—375 KVA, Westinghouse, non-condensing.
1—300 KW, G.E., 3 ph., 60 cy., 220 volt, cond.
1—200 KW, G.E., 3 ph., 60 cy., 220 volt, cond.

TURBO-GENERATORS

1—150 KVA, General Electric Generator, Ames Uniflow engine.
1—62½ KVA, Westinghouse Generator. Fairbanks company engine.

Complete Line of A.C. and D.C. Motors and Generators

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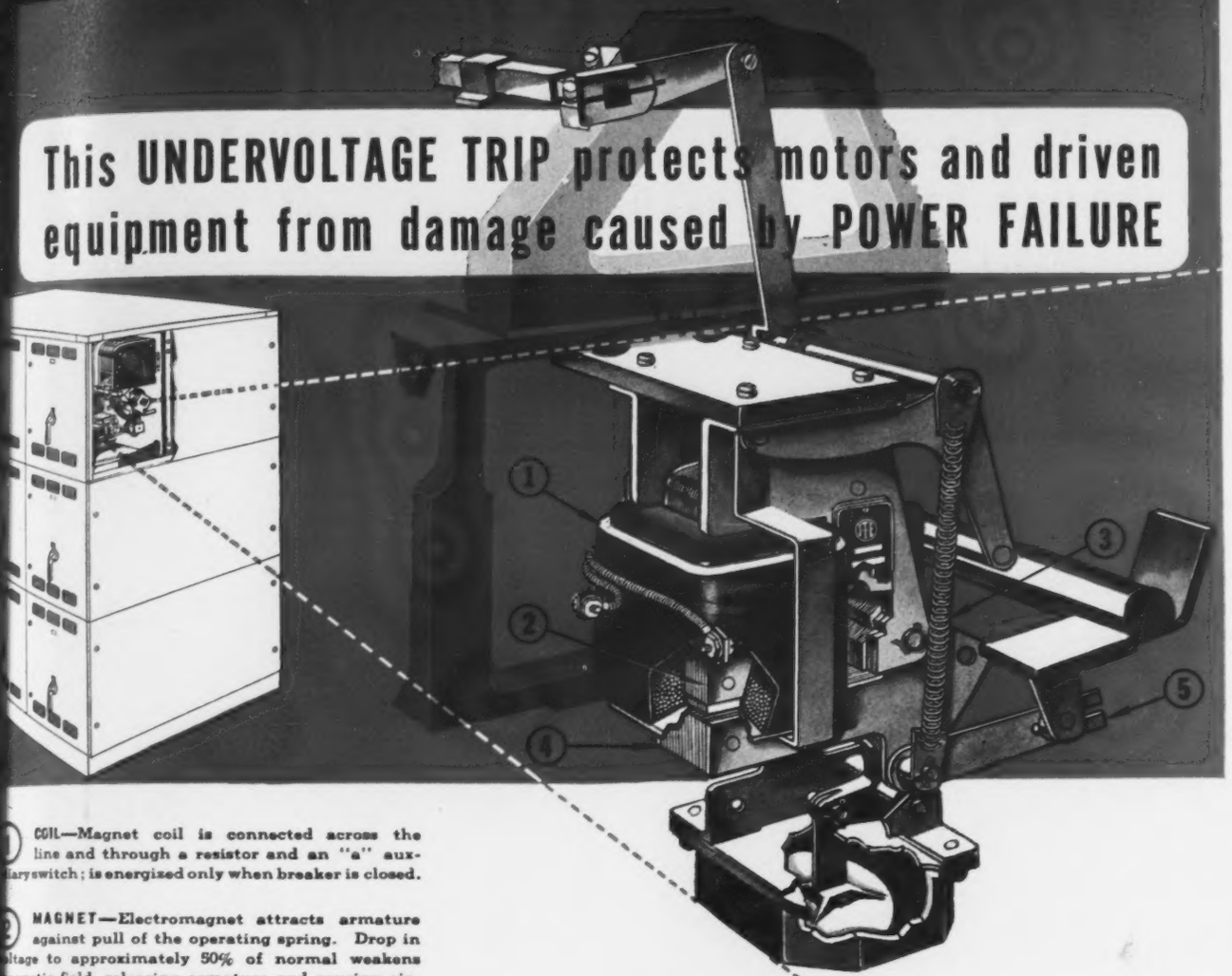
★ **These companies have supplied additional buying information on their products in the 1942 edition of the Electrical Buyers' Reference.**

Features of I-T-E DRAWOUT SWITCHGEAR

This UNDERVOLTAGE TRIP protects motors and driven equipment from damage caused by POWER FAILURE



1. **COIL**—Magnet coil is connected across the line and through a resistor and an "a" auxiliary switch; is energized only when breaker is closed.

2. **MAGNET**—Electromagnet attracts armature against pull of the operating spring. Drop in voltage to approximately 50% of normal weakens magnetic field, releasing armature and causing circuit breaker to open.

3. **OPERATING SPRING**—When circuit breaker is open, spring holds armature against faces of magnet-poles. When circuit breaker is closed a change in position of the linkage makes spring tend to pull armature away. Magnet resists this action.

4. **ARMATURE**—Attracted by magnet against the pull of the operating spring when circuit breaker is closed. Release of armature opens breaker through link to tripper bar.

5. **LINK TO TRIPPER BAR**—Transmits movement of armature to trip mechanism that opens breaker when pull of operating spring overcomes attraction of magnet because of undervoltage condition.

6. **SPRING ARM LINK**—Attached to circuit breaker mechanism at upper end. Releases linkage so that operating spring holds armature against pole faces of magnet when breaker is open. When breaker is closed, it sets arm so that spring tends to pull armature away from pole faces.

Hazards arising from power failure are well known to operating men. The unexpected slowing or stopping of motor drives followed by equally unforeseen resumption of full speed can give rise to conditions damaging for d-c armatures and a-c windings, can do harm to machining and processing equipment, can injure workmen.

Protection against "undervoltage" is simple in principle. A drop to a predetermined, critical value causes a magnet to release an armature and the breaker opens. From that point, there need be no damaging current or unforeseen resumption of power or load.

Simple as this is, what you want on the part of the undervoltage trip is positive, dependable action. This I-T-E gives you—and we will gladly tell you about it to the last detail. Just call the nearest I-T-E representative or write to I-T-E Circuit Breaker Co., 19th and Hamilton Streets, Philadelphia 30, Pa.

Representatives in Principal Cities

I-T-E AIR SWITCHGEAR

Saf-T-Kuhl

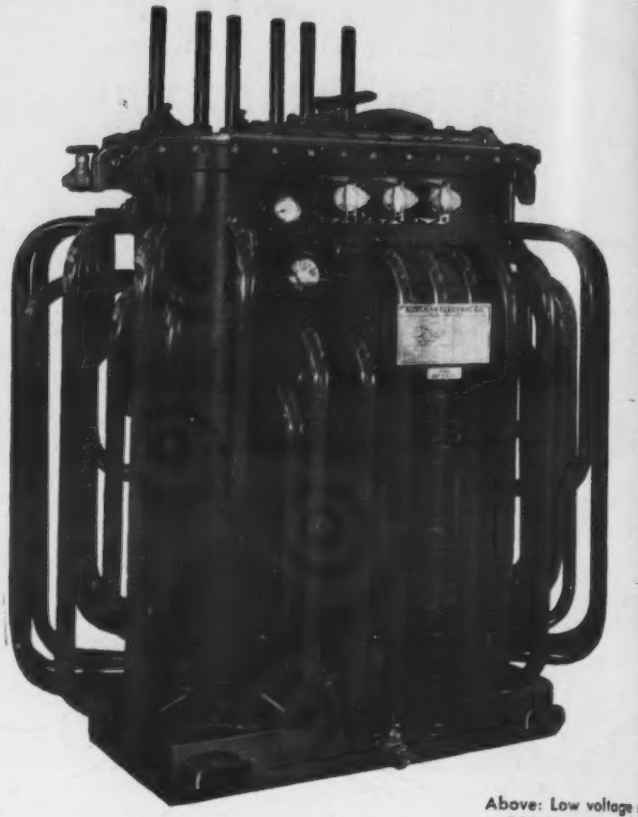
Filled with a non-inflamable, non-explosive cooling fluid Kuhlman SAF-T-KUHL Transformers can be built in a variety of types to meet almost any installation requirements.

SAF-T-KUHL Transformers eliminate the need of expensive vaults. In the smaller sizes, SAF-T-KUHL Transformers may be installed on beams near the ceiling, thus saving floor space. By making it practical to divide existing electrical circuits into several sections, Kuhlman SAF-T-KUHL Transformers result in reduced power losses and better voltage regulation.

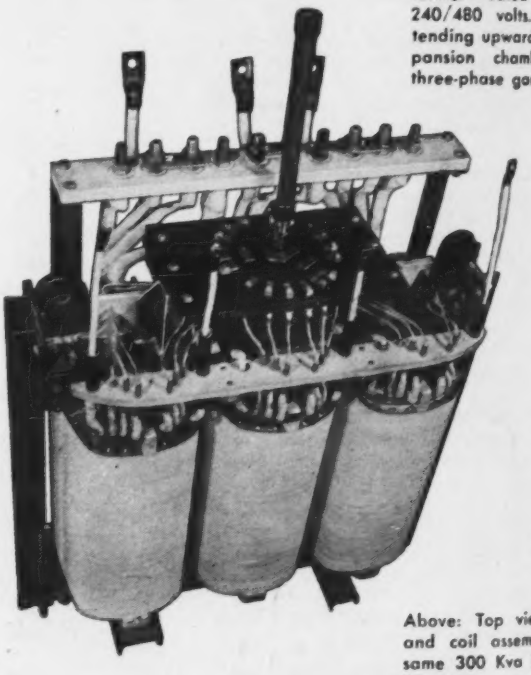
From its sturdy steel frame to its electrically reinforced end coils, Kuhlman SAF-T-KUHL Power Transformers, such as shown here, are built to withstand the stress and strain of constant heavy loads.

For further facts about Kuhlman SAF-T-KUHL'S or Kuhlman Distribution, Power or C.S.P. Transformers or Line Regulators, write to:

Three Phase Power Tran sform



Above: Low voltage si a 300 Kva three-phas cycle SAF-T-KUHL former rated 416 240/480 volts. Pipe tending upward are fa pansion chambers o three-phase gang oper



Above: Top view of and coil assembly of same 300 Kva SAF-T-K Transformer as above s ing tap changer and te nal board

Kuhlman